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Winter on the Marquette Range, Michigan

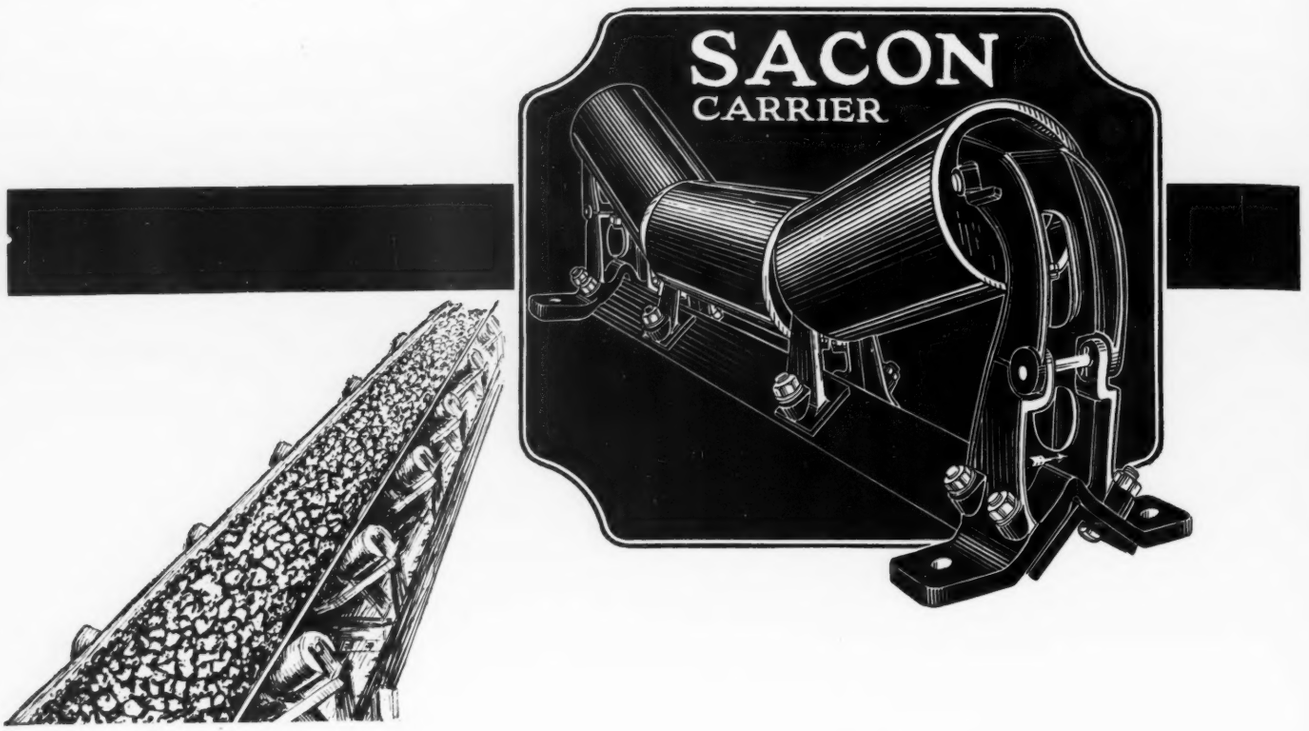
Crushing plant and one of the unique concrete shaft houses at the Cleveland-Cliffs Iron Co.'s Cliffs Shaft Mine at Ishpeming

Mining Methods at Morenci
By McHenry Mosier and John Martin

Proper Use of Lime to Alkalize Mill Circuits
By Clark T. Henderson

Determining Dip and Strike Graphically
By William Johnson Kemnitzer

Mine Taxation in Montana
By M. B. Milligan



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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Acquisitiveness and Public Service

THE COMMONLY ACCEPTED first duty of a man (and the common conception has a way of not being far wrong) is for him to provide material comforts for his family and himself. It is his duty to maintain the standards of civilization: and to see that the family have all the necessities and a few of the luxuries of life. After that, practices differ. The habit of acquisition, once started, is, like most habits, difficult to break. It is not exclusively a human, nor is it in itself a noble, characteristic. Outside of the human, it is strikingly represented in the desert rat, called the "trade" rat. This rat loves to amass great piles of broken glass, bright tin bottle stoppers, all kinds of bright little pieces of human junk—even, if all else falls short, pine cones. In deserted rooms in abandoned mining camps there may be found great heaps of such treasure, entirely useless to the rat, which represent the result of long and sustained periods of hoarding. The rat is called the trade rat because, it is said, when he steals your watch or any glittering object from your cabin, he always leaves something in return—a bit of stone, a pine cone—something, to be sure, that he regards as less attractive than what he takes. The desert dwellers asseverate that this is true. At any rate, the rat is distinctly human in his instincts: at least, many men acquire this habit of useless accumulation.

There are others who believe that when modest material necessities are provided for they owe something to the state. This feeling is more definitely formulated in England than in the United States: but in the United States there are many who, often with more or less characteristic diffidence, endeavor to carry out this higher instinct. Mining men probably feel this urge no more or less than the average. Some few seek to pay their debt to society in politics, but politics is a heroic game, not so popular with gentlemen as in England. Others take up university work, either as teachers or administrators, work for the advancement of engineering standards, volunteer work on some of the varied activities of the engineering societies. If they have surplus dollars, various avenues of philanthropy come easily into view, such as endowing schools of aëronautics or institutions for plant research. Government service of a non-political nature attracts and holds a few of this type.

The idea needs to be stressed these days, that no one has lived a successful life if he has not consciously chosen to try to render public service in some way. A dollar to the Red Cross and a button on your chest will not wipe out the debt. One's whole time and ambition is none too little, if good luck and good conduct has fortunately prepared the way. Many shrink a little after experiment because their good intentions are not appreciated: whether they are experimenting in politics or elsewhere. The great majority who are "on the make" naturally read similar motives on the part of the experimenter; and he is apt to get disgruntled. That, however, is part of the game which must be assumed.

Natural Resources and Railroads

DURING THE PERIOD between 1920 and May 1, 1925, according to a recent report by the Bureau of Public Roads, 2,438 miles of railroad was abandoned in the United States for reasons as follows: (1) Exhaustion of natural resources, 58 per cent; (2) competition of other railroads, 29; (3) competition of motor vehicles on highways, 4.3; (4) rearrangement of railroad mileage, 1.3; and, (5) miscellaneous, 7.3 per cent: all of which goes to show the importance of natural resources, mines and forests, and their relation to other industries.

Statistics prove that for all of the railroads in the United States 51 per cent of the freight handled originates with the mines, and approximately 10 per cent with the forests, thus making 61 per cent of all freight as a product of natural resources. Forests become denuded and mines depleted. There is then but little freight to be handled, and, of course, no need for so much railroad mileage. On the other hand, our forests, grazing lands, and mineral resources were the reason why railroad systems were extended from Colonial United States to the Northern mines and forests, the Western grazing and agricultural lands, the mineral areas of the Western mountain region, and the coal and timber lands of the Appalachian Mountains and the South. Had it not been for these railroads these resources would not have been developed. But once they are developed and exhausted there is then but little need for the railroad. It is therefore not truck competition that is injuring the railroads, but the lack of freight in the form of the products of mine and forest.

Mining for Shooting Stars

THE ROMANCE OF MINING is shown in certain instances where an unusual type of treasure is sought. Coal, iron, copper, lead, tin, and the like are what we think of when we speak of mining; but on the fringe of these commoner things come the gold, the platinum, the diamonds, ruby, and emeralds, all of which have signified beauty, wealth, and glamour since the world began. Mining for oil, which would have seemed extraordinary a hundred years ago, is now a commonplace; but mining for steam, which was mentioned editorially in a recent issue, is unusual.

Some mines or mining operations are unique. Such are the mining ventures which intelligent and substantial investors have conducted intermittently for decades at Coon Butte or Meteor Crater, in Arizona. The object of these operations has been to locate and mine an immense shooting star, or meteor, which, it has been believed, embedded itself in the earth at no distant date.

Meteor Crater is a great circular pit, 600 ft. deep and 4,000 ft. in diameter, of evident crater-like origin, in horizontal sandstones and limestones of Central Arizona. The walls are precipitous, and the normally horizontal strata of the walls are bent up so that they dip away from the hollow. Two theories were advanced by geologists: One that the pit was formed by the impact of a gigantic meteor and the other that it was due to an explosion of volcanic gas. The weight of geologic opinion has leaned toward the former explanation; and a great deal of exploration, by pits and drill holes, has been done, with the hope of being able to mine the iron which wandered hither from unknown worlds and was finally trapped by the earth's attraction. Geologists did not consider this by any means a vain hope. Prof. H. L. Fairchild wrote in 1907:

"All the phenomena thus far found in the long and careful exploration of the crater, the distribution of the wreckage both inside and outside, and the composition and structure of the materials, seem to be fully and satisfactorily explained on the theory of impact by a celestial bolide of high velocity, and do not fit any other theory."

And Prof. George P. Merrill, in a most recent paper on the subject (1920), comes to the same conclusion. It is true that limestone blocks have evidently been hurled from the crater and that the sandstone which once partly filled it has been transformed in some way to a silica powder, and scattered thus around the vicinity; but this has been regarded as due to the impact and the reaction; and bore holes seem to demonstrate that these disturbances do not persist in depth, thus disproving the idea of outbreak from below.

Be that as it may, the repeated attempts have not located any buried meteorite; and it is improbable that further efforts will be made. The first attempts were made by the Standard Iron Co., guided largely by D. M. Barringer, of Philadelphia. The first efforts at boring beneath the crater having proved unsuccessful, more recently another attempt was made, largely financed, it was reported, by the United States Smelting, Refining & Mining Co.; and it was reported that the new explorations would be on the theory that the meteor had come in a diagonal position, instead of straight down, and therefore should be looked for under the rim of the crater instead of beneath the pit. But these renewed efforts have also been unsuccessful, and therefore there will probably always remain a certain amount of mystery about this mining romance.

Keeping the Roads Open

IN THE LACK of transportation lies the cause of China's backwardness—not in the psychology of the people, unless it be reasoned that the absence of roads is due to the blind acceptance by the Chinese of the idea that established conditions cannot be changed. Whatever be the ultimate cause, development of that country has been retarded largely by the lack of roads and railways.

What is true of China as a whole throughout the year is true of many a mining camp in the United States at times. As if it were an unchangeable thing, many a community meekly submits in winter to the hardships and inconveniences of being cut off from its neighbors. This attitude of mind is a survival of the horse age. Horse-drawn vehicles were useless or almost so when roads were blocked with snow. Not so today. With the tractor and the motor plow, organized community effort finds it comparatively simple to keep the arteries of travel clear. A matter of importance this, when the country's roads are carrying a heavier traffic of buses, motor trucks, and cars than was scarcely thought of years ago. Of surfaced roads the United States has over 430,000 miles, more than half of which lie within regions having over 20 in. of snowfall annually, which naturally interferes at times with traffic.

The importance of bus transportation in many sections of the country has perhaps not been generally recognized. Inhabitants of the Minnesota iron country, for instance, are being served today by a network of lines that make travel from the Cuyuna to the Vermilion range and from one end of the Mesabi to the other a very simple matter. Convenient hourly schedules and comfortable transportation by bus have resulted in greatly decreased travel on the railroads that connect the numerous mining points, making serious competition possible, for the time at least. Here the need of maintaining open roads is readily apparent.

In camps that are more remote, served by poorer roads, the problem of keeping communications open is just as vital. Here the recently developed snow motor, with its surprising capacity for hauling, is satisfactorily meeting a long-felt want.

Some day, perhaps, man will no longer need, wormlike, to crawl the earth, following its contours or dragging himself over its elevations. Instead, he will use the air, demonstrating the old proposition that a straight line is the shortest between two points. Then the problem of keeping roads open will have disappeared. But for the present, which is the only time that mankind has, the problem is one of great importance.

The Heads of Societies

MANY ENGINEERS have given thought to the problems of selecting presidents for scientific, technological, philanthropic, and other types of societies for the furthering of the common knowledge and welfare. Whether these are incorporated or not, the plan of government is essentially democratic—that is, the individual member is supposed to help to elect the officers as well as to determine the policies. Actually, expediency in most cases has left the government to a little group, which is willing to work and potter, and serve. It would be wearisome to repeat the names of the societies and the institutes which are governed in this way—the American Institute of Mining and Metallurgical Engineers is an example. The Mining and Metallurgical Society of America, which was organized largely as a protest against the undemocratic government of the Institute, has followed in its footsteps in this respect. Formerly, there was a genuine competitive election; but last year and this year only one candidate appeared on the ballot.

It would be unfair to criticize these organizations without giving full weight to the immense obstacles which stand against the literal carrying out of the principles of government provided for in the organization of these institutions, and without noting that not only these but a host of other institutions in other lines have found it easiest to adopt similar methods. For example, an exceedingly high-minded and noble society, not at all connected with mining, has just sent this letter to its members:

"The annual meeting is to be held at three-fifty on Monday, Dec. 23, for the election of officers for the coming year.

"The present officers are [etc]. "These officers have been proposed for re-election. A formal proxy is inclosed. It is requested that you fill in and return to me this proxy on the understanding that I shall cast your vote for the re-election of the present officers.

"Yours sincerely,

———— ————, Secretary."

There, at least, is a clean-cut proposition. One knows where one is at. The election in this society, as in most others, is a mere gesture of courtesy to the members—a polite but insincere gesture—like the Spaniard who tells you his house is yours. In spite of the convenience of these methods (and to tell the truth, in many cases, their necessity) they have their drawbacks. Selections for presidents and other officers are often poor, and so it results that men who have not earned this honor are given it for reasons of friendship or expediency: with the result that it ceases more and more to be an honor—in proportion as the membership at large are keen at distinguishing form from substance.

The real fact is that a president elected annually holds his job for too short a time to be worth going to much trouble about—such trouble as a real election, for example. The practical result is to leave the carrying out of policies year by year to a permanent secretary, or to a permanent group in the board of directors. Yearly rotation of presidents who really preside has the result of preventing any consistent carrying out of definite policies; and the result is that the average president does not try. In many cases he does not even try to familiarize himself with the history and activities of the institute of which he has been elected head.

Another solution which has been recently suggested is the long-term or permanent president. The permanent presidency has been the solution to this problem arrived at by the universities and the corporations. This is also the solution of a host of scientific, technical, and educational institutions of various kinds. Certainly, the present plan is not a successful one, any more than in the past the ideal principle of genuine annual elections has proved to be so.

Interest in Rock Crystal

AT A RECENT MEETING of the Institute of Mining and Metallurgical Engineers, W. H. Staver called attention to the increasing interest being taken in rock crystal. Fine specimens of rock crystal have always commanded a certain price, but this commodity was more or less handled on the same basis as mineralogical specimens. The larger and more perfect the specimen, the greater its value and, in the instance of an exceptionally large mass, prices mounted to a considerable figure.

The growing interest taken in rock crystal beads has assumed the proportions of a well-established fad, such that many women consider a rock crystal necklace essential to their well-being. As a result, the demand for this kind of jewelry has grown amazingly. With it has grown up also a demand for rock crystal, as the incidental stocks of this mineral were only sufficient to supply a nominal amount and there was no regular buying of the raw mineral. A market has now been established, but the lines about it are such that he must be shrewd indeed who obtains a full measure of value for his rock crystal. Standards are also uncertain, but these will be eventually reduced to a common basis as the business increases in importance. Thus another mineral becomes an article of commerce, but, unfortunately, the nature of its occurrence is such as probably to preclude systematic mining. The business of finding this mineral belongs to the intelligent prospector.

Resolutions

OF WHAT VALUE are resolutions? As expressions of collective opinion they are intended to mold the public mind and influence the decisions of lawmakers with respect to pending or needed legislation. Their value depends largely on the standing and influence of the body from which they emanate. They should then be carefully considered, and framed with prayer and caution by those who are competent to speak and truly representative of the interest for which they are the mouthpiece. Many resolutions are not thus carefully drawn, and therefore are worth but little as indicators of the true sentiment in an industry. Indeed, as speeches are to a banquet, so resolutions seem to be to the average convention. The after-dinner speech has become a jest—so much so that it is often without influence upon its hearers. In just such a descent from the respected to that which is ridiculous, the resolution, *per se*, is rapidly becoming boresome. The law of supply and demand works here as elsewhere. There are too many resolutions, and so their value falls.

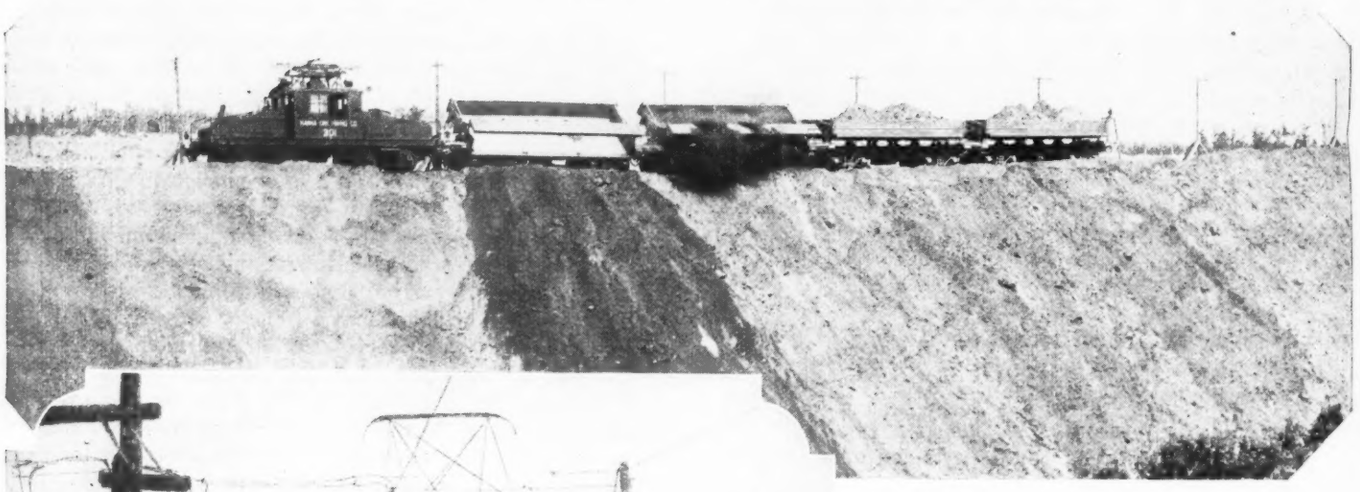
Some statistician—one of the type that has a real passion for statistics—might figure how many resolutions were adopted in 1925. His calculations might help in curtailing convention programs. Were it known that from January to June 649 resolutions urging lighter taxes had been introduced by as many bodies, the gentlemen about to frame the 650th might be persuaded to desist. Perhaps some such statistician has been at work, for at the recent mining convention held in Washington only six or eight resolutions were adopted, some being simply complimentary. This marks an advance in the development of that body. After all, resolutions are words, and though words be winged, some have only rudimentary wings. Three mining conventions in thirty days have adopted nearly forty resolutions, most of them looking to possible legislation. The too many pestiferous laws with which society is afflicted all had their beginnings in resolutions, the larvæ of the insects.

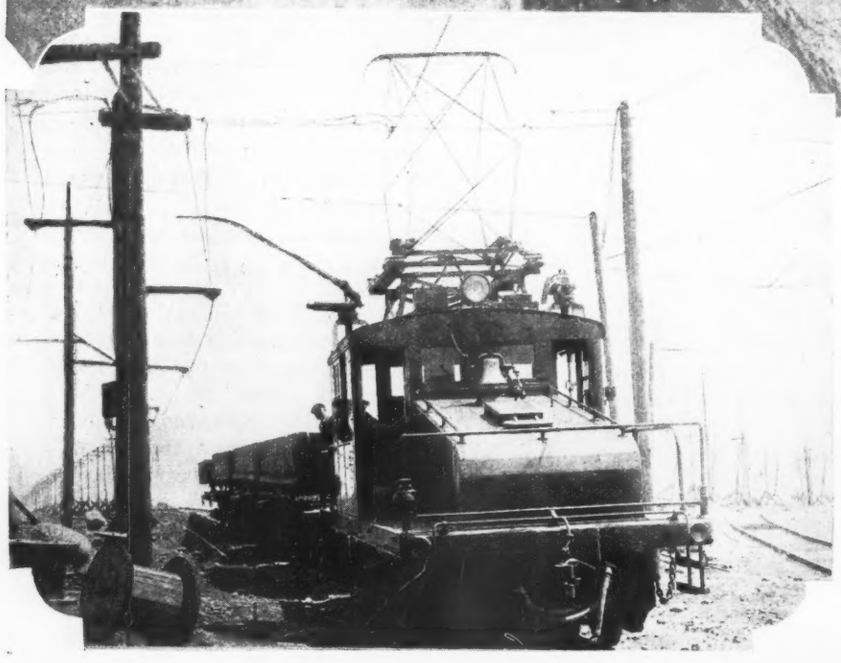
What happens to resolutions? is the question often asked. Forgotten, is the answer. Forgotten, because never thought of afterward. Forgotten, because they were not worth remembering. In expressing its stand on current problems, an organization will do well first to choose the issue carefully, and then to make its words few, forcible, and well selected.

The Iron Pillar of Delhi

EVIDENCE CONTINUES TO ACCUMULATE that the technicians of old knew a thing or two, and that what they did is often puzzling to us moderns. The iron pillar of Delhi, in India, was erected about 300 A. D., is about twenty-three feet high, and weighs between six and seven tons. How it was made is a mystery, and why it has not rusted, having remained intact for 1,600 years, is not understood by the Copper and Brass Research Association. A recent analysis shows the iron to be unusually pure except for 0.114 per cent of phosphorus, and photomicrographs show no slag inclusions. Sir Robert Hadfield finds much that is unexplainable, even after modern methods of analysis and examination have been applied.

Electrified Open Pit Iron Mining on the Mesabi Range





Oval—Eight cubic yard 350-ton electric shovel, designed for use either as shovel or dragline, loading ore at Buhl, Minn., in the Hanna Ore Mining Co.'s Wabigon pit, the first in the world to be completely electrified. Center — Sixty-ton electric locomotive and 20-cu.yd. dump cars on dump. At left— Electric locomotive close up. The trolley wire is carried at side on loading tracks and on dump, and overhead on main tracks.

Three views of the 350-ton electric dragline at the Hanna company's La Rue mine at Nashwauk, Minn. This machine is designed also for use as shovel and has practically the same electrical equipment as the shovel opposite.

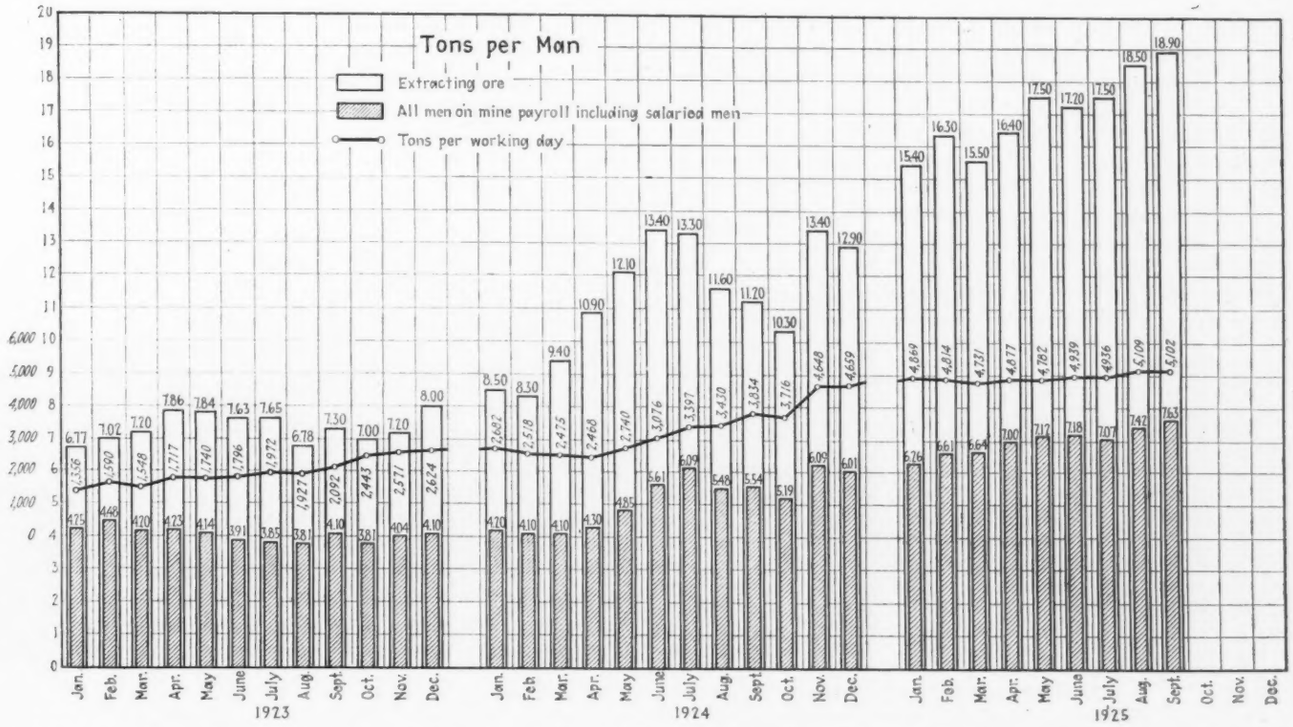

Tons per Man
Extracting ore
All men on mine payroll including salaried men
Tons per working day
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1923
1924
1925

Fig. 1—Chart showing tons per man-shift, Morenci Division, Phelps Dodge Corporation, based (1) on all men on mine payroll including salaries, and (2) on men extracting ore only. Total mine production per working day is also shown

timbered slide system. An important feature of this system is the elimination of hand tramming in the stope itself. In many instances, the ore can be run from the timbered slide directly into branching storage-motor chutes, without the necessity of hand tramming.

The Morenci timbered slide method as at present developed is a system of block caving laid out in panels 150 ft. wide, with hand tramming drifts on either 40- or 50-ft. centers, and with inclined slides at right angles to these drifts on 20-ft. centers (see Figs. 3 and 4). The slides are driven on a 33-deg. slope, leaving 10 ft. of solid ground between the upper ends of adjacent slides in any given row across the panel. The details of the timbering of the slides are shown in Fig. 5. Boundary shrinks, having a minimum width of 6 ft., are run on the end and along the sides of the panel in advance of undercutting. These shrinks are essential except along the panel boundaries adjacent to stoped

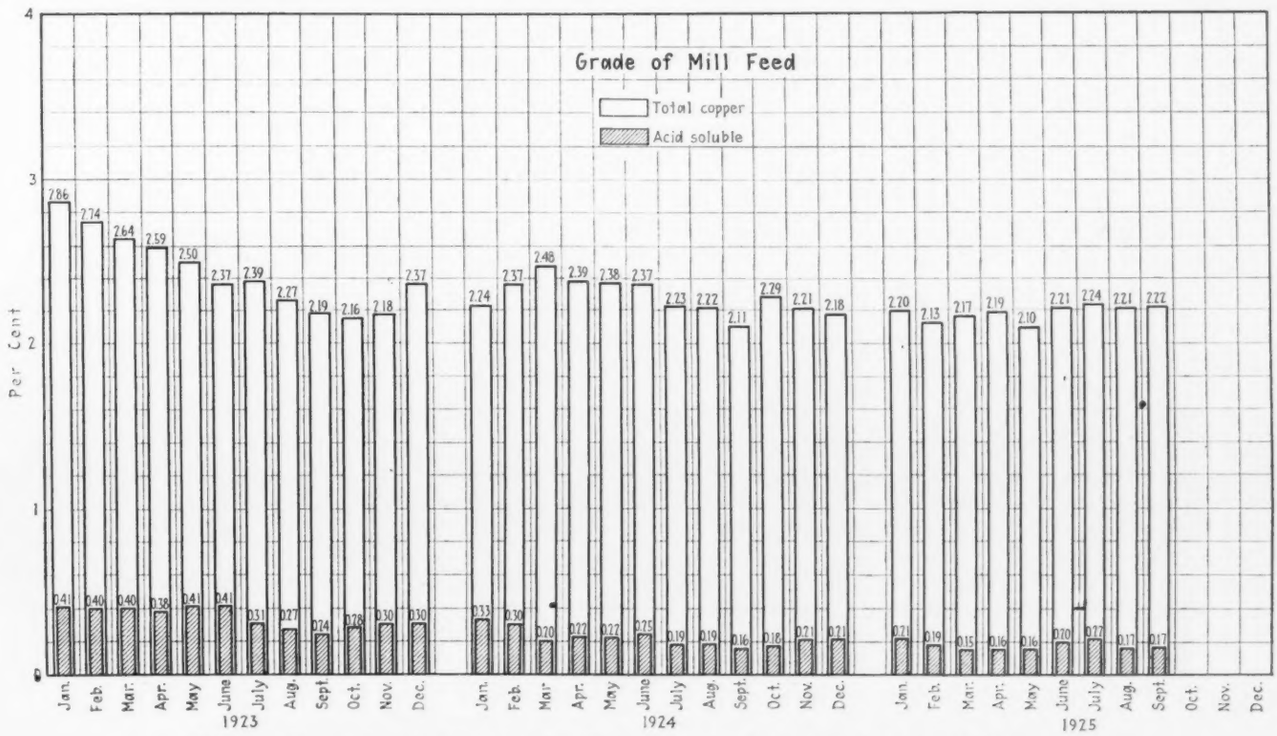


Fig. 2—Chart showing grade of mill feed for both total and acid soluble copper

Mining Methods at Morenci

Two New Systems, the Timbered Slide and the Block Cave, Developed in Last Three Years, Have Resulted in Appreciable Economies at Properties of Phelps Dodge Corporation

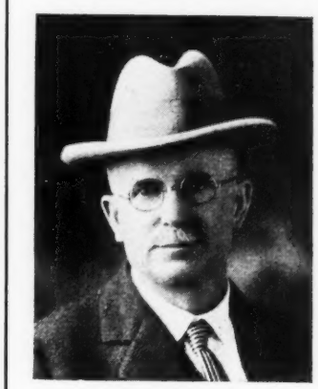
By McHenry Mosier and John Martin
Mine Superintendent and General Mine Foreman, Phelps Dodge Corporation, Morenci, Ariz.

McHenry Mosier

SINCE operations were resumed at Morenci, Ariz., in 1922, some developments have been made in block caving which have resulted in appreciable economies in mining at the properties of the Phelps Dodge Corporation at this place. Two distinct systems have been evolved — namely, the Morenci timbered slide and the Morenci block cave. The former is similar to the Miami method but with the hand tram drifts converted into inclines, while the latter is based on the Inspiration system with controlled drawing.

The Morenci timbered slide method was initiated during 1923, and the branch raise system, from which the Morenci block cave method originated, was started with actual stoping operations in 1924. The tonnage from these two systems has gradually increased until it now forms about 95 per cent of the total from stopes. The remaining 5 per cent comes from open stoping on flat veins and from inclined brow caving.

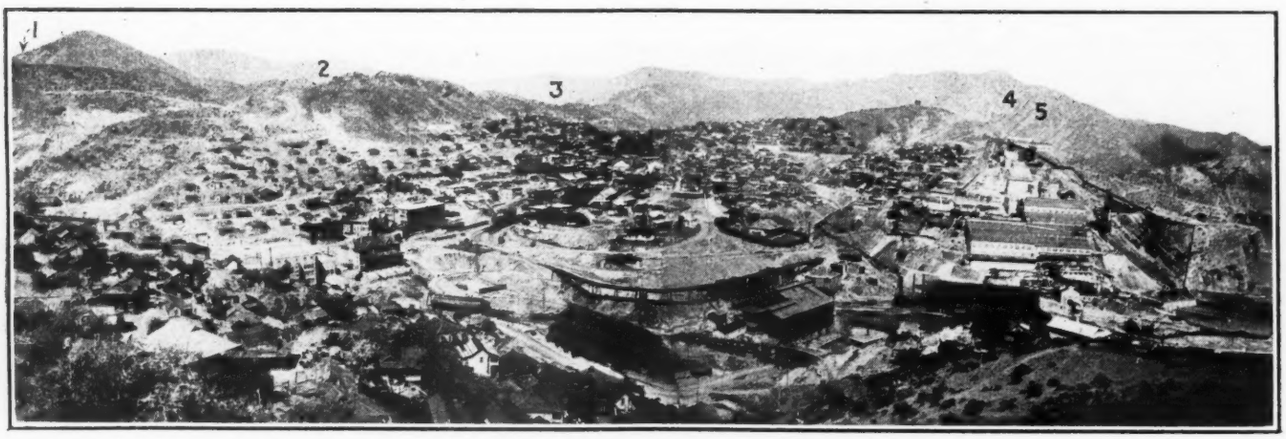
Accompanying charts show operating statistics for the entire Morenci division since January, 1923. Fig. 1 shows the tons per man-shift based (1) on all men on mine payroll including salaries, and (2) on men extracting ore only. The total mine production per working day is also shown on this chart. Fig. 2 shows grade of mill feed for both total and acid-soluble copper.



John Martin

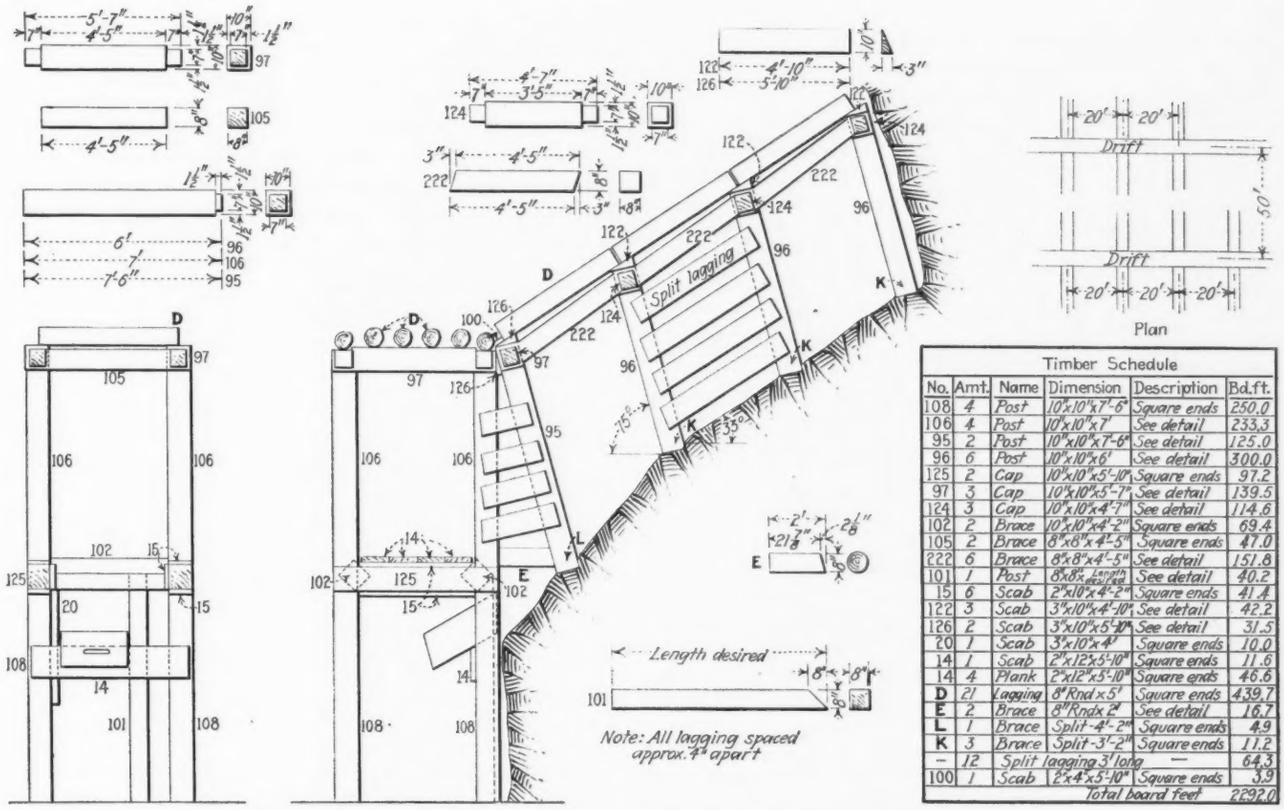
Most of the production now comes from the Humboldt mine. Here the ore occurs in granite porphyry or monzonite porphyry along, and at the intersection of, the Copper Mountain and Fairplay faults. It is a chalcocite ore of secondary origin, carrying about 2 per cent copper. The ground is much harder than that in the average porphyry mine. The orebody has a length of 2,000 ft., a maximum width of 600 ft., and a vertical range of 1,000 ft. The extraction of the upper 350 ft. is almost completed. The Morenci block cave method of mining is being applied to the lower part of the orebody, below the old stopes, while the Morenci timbered slide method is being used to "base level" the mine at 350 ft.

To start production with the least delay, the development in the Humboldt mine that was done before the consolidation of the Arizona Copper Co., Ltd., with Phelps Dodge Corporation was made use of as far as possible. At first, several established systems of mining were put into effect, including (1) brow caving with shoveling; (2) incline slicing; and (3) the Miami caving method. Later a system better adapted to local conditions was developed. On the first level many crosscuts had been driven on 50- and 60-ft. centers. The problem of drawing and delivering the ore to chutes along these crosscuts was sloved by the adoption of the



General view of Morenci, Arizona, looking north

1, Arizona Central shaft. 2, Humboldt mine. 3, Joy supply shaft. 4, No. 6 hoisting shaft. 5, No. 6 concentrator.



Timber Schedule

No.	Amt.	Name	Dimension	Description	Bd.ft.
108	4	Post	10"x10"x7'-6"	Square ends	250.0
106	4	Post	10"x10"x7'	See detail	233.3
95	2	Post	10"x10"x7'-6"	See detail	125.0
96	6	Post	10"x10"x6'	See detail	300.0
125	2	Cap	10"x10"x5'-10"	Square ends	97.2
97	3	Cap	10"x10"x5'-7"	See detail	139.5
124	3	Cap	10"x10"x4'-7"	See detail	114.6
102	2	Brace	10"x10"x4'-2"	Square ends	69.4
105	2	Brace	8"x8"x4'-5"	Square ends	47.0
222	6	Brace	8"x8"x4'-5"	See detail	151.8
101	1	Post	8"x8", Length as required	See detail	40.2
15	6	Scab	2"x10"x4'-2"	Square ends	41.4
122	3	Scab	3"x10"x4'-10"	See detail	42.2
126	2	Scab	3"x10"x5'-10"	See detail	31.5
20	1	Scab	3"x10"x4'	Square ends	10.0
14	1	Scab	2"x12"x5'-10"	Square ends	11.6
14	4	Plank	2"x12"x5'-10"	Square ends	46.6
D	21	Lagging	8" Rnd x 5'	Square ends	439.7
E	2	Brace	8" Rnd x 2'	See detail	16.7
L	1	Brace	Split-4'-2"	Square ends	4.9
K	3	Brace	Split-3'-2"	Square ends	11.2
–	12	Split lagging 3' long		—	64.3
100	1	Scab	2"x4"x5'-10"	Square ends	3.9
				Total board feet	2292.0

Fig. 5—Sketch showing standard timbering of Morenci timbered slide

8-ft. pillars should follow the completion of each drift as closely as possible. The undercutting thus continues by successively blasting units 56 by 14 ft., retreating across the panel.

In the drawing-off operations, changes have been made which help to maintain a more continuous flow of ore. In the first place, the motor chutes having an inclination of 60 deg. were too flat. The fine ore built up on the bottom until the cross section became so small that it was hard to draw out the ore. Many costly delays, especially aggravating to men and bosses working under a bonus plan, resulted from the branch raises "hanging up." For these reasons, the branch raises were eliminated, by driving a single raise on a steeper slope, to a point on the grizzly level midway between the two former branches. (Fig. 10.) By this change, the total feet of raising has been cut 40 per cent, and the total cost has been reduced about 50 per cent, in both raw and timbered raises. Loading conditions with the steeper chutes have been very much improved. The 14-ft. grizzly centers have been maintained by slotting the bottom of the grizzly drifts to form slides so that the ore from two pairs of fingers can flow into one chute. The grizzly drifts are being driven small, about 3 by 6 ft. in cross-section, so that in most of the work timbering is unnecessary. Finger raises are also being

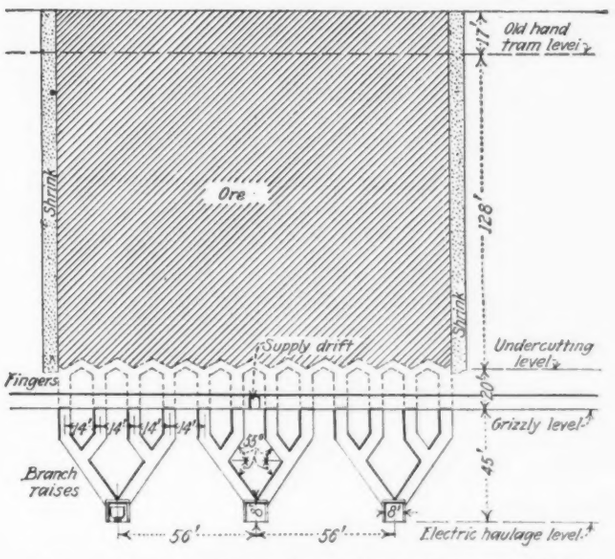


Fig. 6—Cross-section through panel prepared for modified Inspiration system

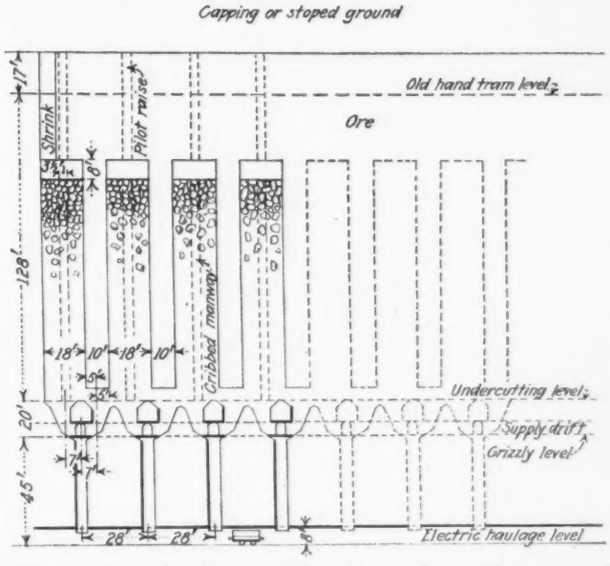


Fig. 7—Longitudinal section through panel prepared for modified Inspiration system

ground. They are stoped upward with stoping drills to a point within about 8 ft. of the top of the block to be mined, and are worked in successive cuts, similar to rill stoping, thus maintaining an entrance over the sloping muck pile. The necessity for cribbed manways from the timbered incline below, or of rock raises to the level above, is thereby eliminated.

Undercutting then starts at the end of the panel, proceeding along the line of retreat of the stope. (Figs. 3 and 4.) There are two stages in undercutting. The first consists of drifting across the backs of the timbered slides, parallel to the side shrink, on 10-ft. intervals. The second stage consists of blasting the 5-ft. pillars, retreating across the panel. The backs of the undercutting drifts are drilled to a height of about 8 ft. These holes are shot simultaneously with the blasting of the pillar.

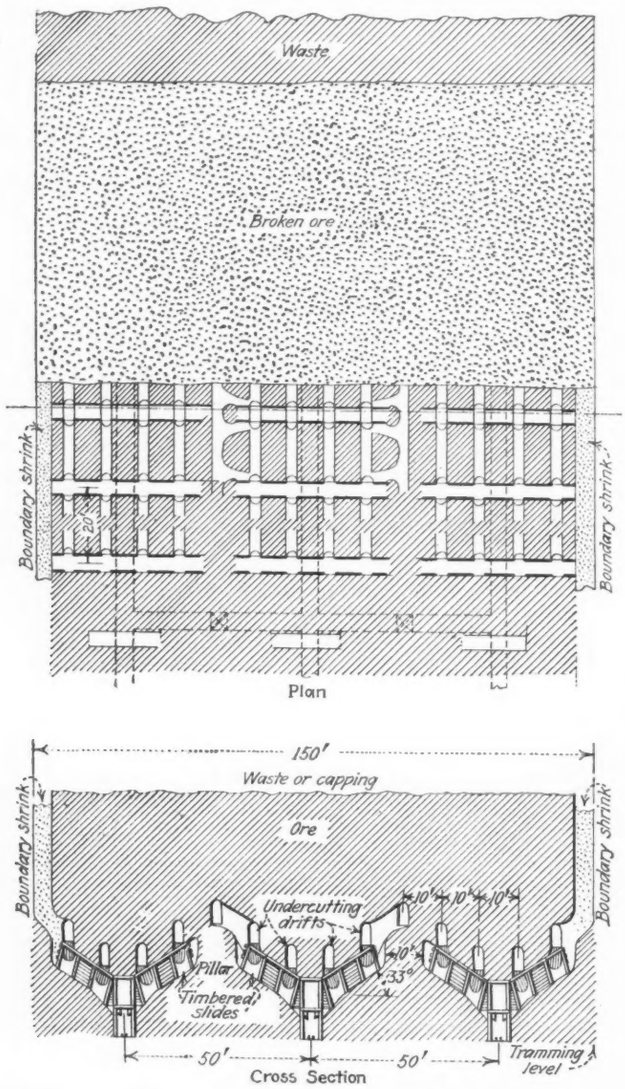


Fig. 3—Plan and vertical section showing Morenci timbered slide system of mining

The Morenci timbered slide system is best adapted to the softer ore with lifts of from 30 to approximately 100 ft.

When the Morenci block caving system was started it was called the "branch raise" or "modified Inspiration" system. Tunnels were run on the haulage level on 56-ft. centers, to accommodate 10-ton cars. At intervals of 28 ft., in these tunnels, raises were run on each side, to serve as ore chutes. (Figs. 6 and 7.) The raises were driven on a 60-deg. incline to the grizzly level 45 ft. above. About midway in each raise a branch was driven to the grizzly level. Grizzly drifts were driven across the panel over each line of raises and grizzlies installed on 14-ft. centers. Two finger raises were run from each grizzly to the undercutting level 20 ft. above. The drawing centers are thus on the corners of 14-ft. squares. At first, heavy timber was used for chute fronts to control the flow of ore.

The ore column above the undercutting level had a height of 140 ft., but later, in the blocks now being mined, this will be increased to 200 ft. The ground was very hard, and to break it up as much as possible the Ray system of rooms and pillars was adopted. Boundary shrinkage stopes about 8 ft. wide were mined to an elevation of about 10 ft. below the top of the ore, so as to cut off the panel to be caved. A transverse shrink 18 ft. wide was mined to a height of at least 70 ft. The adjacent 10-ft. pillar was undercut and caved as soon as the transverse shrink ahead of it was completed. The relative width of the room and its pillar, as well as the height to which the room should be carried, depends on the character of the ground. (Fig. 8.) Three pilot raises in each room, run from the grizzly level to an old level 150 ft. above, served for ventilation and manways. As the rooms were advanced, cribbed manways were first carried up through the broken ore, but these began to fail when a height of 60 ft. was reached. They proved too expensive and dangerous, and were later abandoned. Communication was then maintained through the pilot raises from the level above. This method of breaking and caving the ore has been very satisfactory, in view of the hardness of the ground.

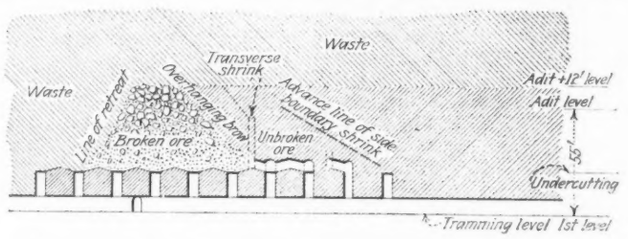


Fig. 4—Longitudinal section through 1-48-1 Stope, Morenci Branch, Phelps Dodge Corporation

In softer ground, horizontal undercutting in connection with the boundary shrink is sufficient to cave the block without the necessity of running the transverse shrinks. The horizontal undercutting is done much in the same manner as in the Morenci timbered slide system. (Figs. 8 and 9.) Drifts 6x7-ft. in cross-section are run parallel to the side boundary shrink over each row of fingers through a distance of 56 ft. in advance of the caved ground. This is accomplished by attacking it from each finger, beginning 5 ft. below the undercutting level and inclining to the point of connection, which is halfway between fingers. Crosscuts are also driven at right angles to these drifts over each row of fingers. The fingers are belled, simultaneously with blasting the intervening 8-ft. pillar, so that the top of the floor pillars becomes a series of sharp ridges. At least one cut, and sometimes two cuts, are taken out of the back, to provide room for expansion and thus insure the caving of the ground. The blasting of the

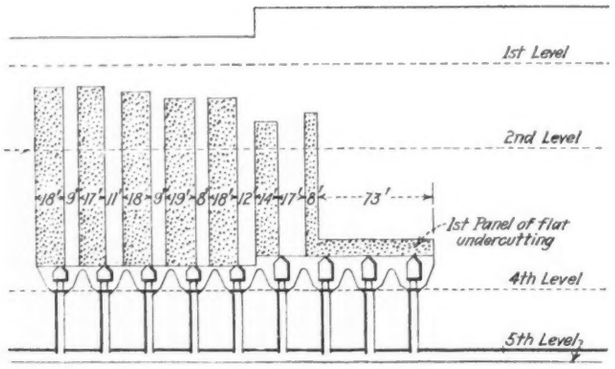


Fig. 8—Longitudinal section through 4-34 Stope, showing change from wide shrinks and narrow pillars to narrow shrinks and wide pillars and finally to flat undercutting

started small, by first crosscutting 6 ft. from the grizzly drift before starting to raise. In this way, a brow is left which will control the ore flow and render unnecessary the placing of timbers or control doors as formerly.

The grizzlies are constructed by laying four pieces of 50-lb. rails, 9-ft. long, on three timber supports. (Fig. 11.) The rails are spaced 10 in. apart by using wooden blocks, accurately cut at the saw mill.

The Morenci block caving method is better adapted to the harder ground with lifts of 100 ft. and greater.

The drawing of all caving stopes is controlled by the engineering department. When the undercutting is being done, the tonnage obtained from undercutting drifts, shrinks, and pillars is shown in color on the drawing charts, with its location posted as accurately as possible. The tonnage from the undercutting drifts is calculated from the footage shown each week on the undercutting progress maps, and is checked against the actual weights at the end of the month. The tonnage pulled from the shrinks is turned in each day by the shift boss, and these figures are used for posting the shrink tonnage. It is estimated that for every ton of ore drawn in driving the shrink there is left one and one-half tons of broken ore. As soon as the next stage of the undercutting is started—that is, breaking up the pillars left between the undercutting drifts—a chute checker is sent into the stope with a blank draw sheet. He is instructed to draw off the pillars as soon as they are blasted, and record on his draw sheet the exact location of the tonnage. The chutes or fingers leading to these newly blasted pillars are drawn dry

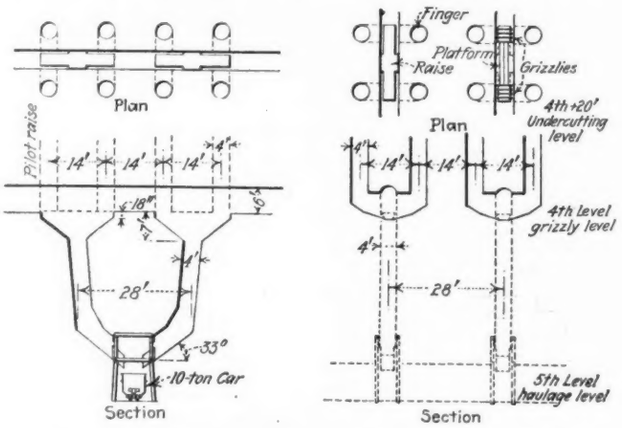


Fig. 10—Haulage level raises showing fingers and grizzly stations

every day for two or three days to give the solid ore above room to expand.

As the undercutting advances and more pillars are broken up in the front part of the stope, more tonnage becomes available in the back part of the stope, and the chute checker's draw sheet will show how much ore should be drawn from each individual chute to get the daily tonnage required from that stope and at the same

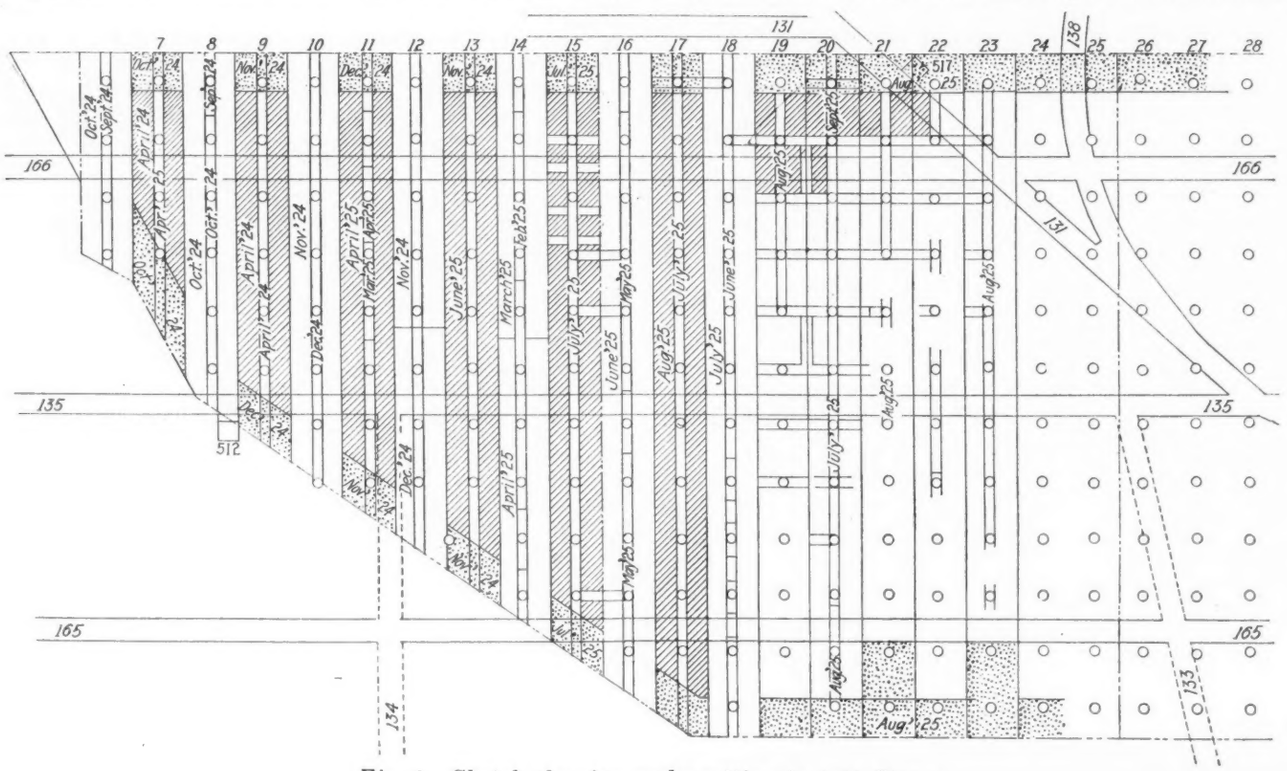


Fig. 9—Sketch showing undercutting in 4-34 Stope

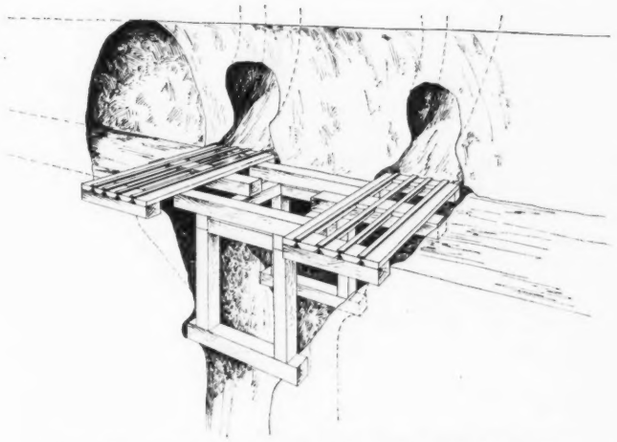


Fig. 11—Sketch of grizzly station, 4-36 Stope

time to maintain a certain angle of retreat between the broken ore and the waste.

To establish the proper angle between the broken ore and the waste a number of factors must be taken into consideration. A slope very close to the horizontal would be desirable in maintaining a flow of clean ore, giving a minimum dilution, but this would require a large area to be open at one time, and hence a maximum weight to be supported for a greater period of time.

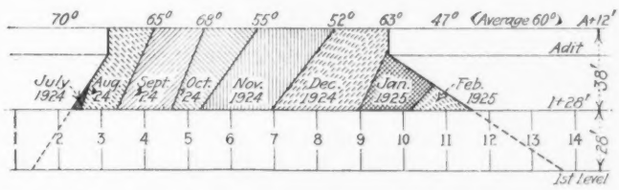


Fig. 12—Composite section through 1-48 Stope, which shows angle of retreat to have an average of 60 deg.

It also requires a larger amount of working capital. A slope very close to the vertical would reduce the weight to a minimum, but it would also increase the dilution to a point where it would be impossible to get any clean ore. Between these two lies an angle that, although giving only a moderate dilution, will permit a stoping area large enough to furnish the scheduled daily tonnage, without excessive repairs. (Fig. 4.) The character of the ground being caved, the method of caving, the thickness of the protecting pillars between drawing points, the grade and character of the overburden, as well as the daily tonnage required, the size

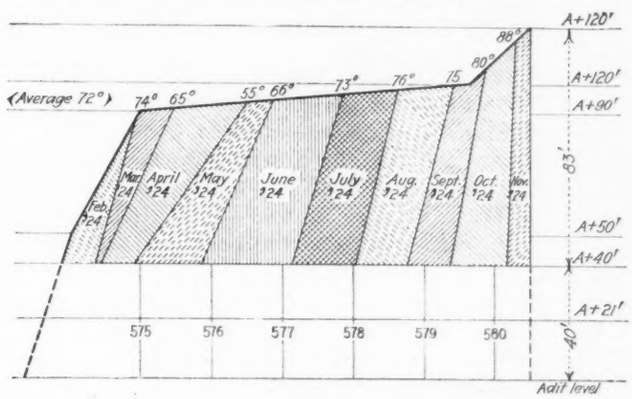


Fig. 13—Composite section through A-38 Stope, in which angle of retreat was about 69 deg. to keep stoping area at a minimum

of the drawing area, and weight of the stope are all factors that must be considered when deciding upon an angle to be maintained between the broken ore and the waste, in a given orebody. An angle of 60 deg. has been established at Morenci as the best average slope to get the maximum tonnage of ore with a comparatively small dilution and at the same time to keep the mining area within certain limits. As conditions change the angle of retreat may be varied, averaging about 60 deg.

If a certain angle has been established between the broken ore and the waste, say 60 deg., and the weight becomes so great that repairs are too expensive, the drawing area can be decreased without reducing the broken ore available, by running a transverse shrink across the stope at the front edge of the undercut area. In some special cases the drawing area may have to be

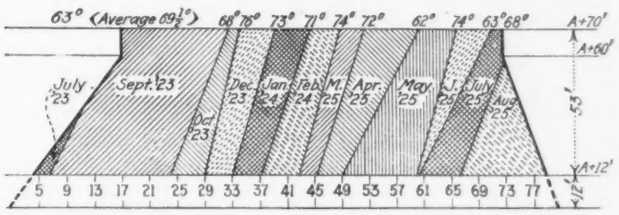


Fig. 14—Composite section through A-48 Stope, where the average angle of retreat was 69½ deg.

still further reduced on account of the weight by increasing the angle of retreat to as much as 70 deg.

A long overhanging brow above the area undercut increases the drawing area, and a short brow decreases the area. This brow may be vertical or hang as flat as 30 deg. from the horizontal, depending upon the character of the ground, the overburden, and the comparative speed of drawing to undercutting. The trans-

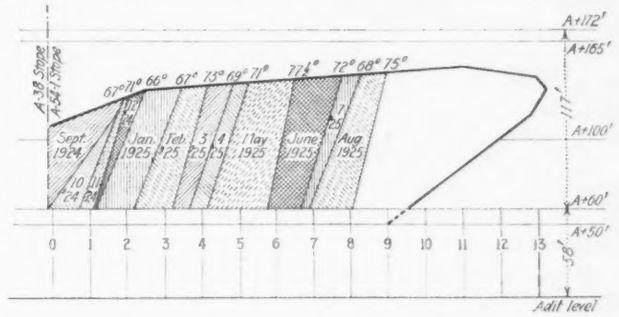


Fig. 15—Composite section through A-54 Stope

verse shrink, mentioned above, automatically cuts down the length of the overhanging brow. For example, if the brow lies at 30 deg. a shrink 15 ft. high will cut off 26 ft. from the length of the brow, or, if the brow lies at 60 deg., a 15-ft. shrink will cut off 8½ ft. This brow is, in effect, a cantilever which fails when the total weight supported exceeds its strength. If it does not shear along the edge of the undercutting, overthrust extends to the advance development. To prevent this, transverse shrinks are run on about a 50-ft. interval. The height of these shrinks varies with the character of the ground and the lift. This drops a smaller unit than the former practice, with less shock to the grizzlies.

The line between the broken ore and the waste must not intersect the overhanging brow, or some of the ore at the upper end of the brow will be lost. It is better to have at least 20 to 50 ft. (depending upon the lift) between the tip end of the brow and the waste line.

In drawing a large stope with a high lift, a wedge of broken ore is left along the side or end along which another stope is later to be mined. The slope of this wedge of broken ore is steepened to 70 deg. in order to tie up a minimum amount of ore. After the adjoining stope is finished, this wedge of broken ore is drawn, starting at the center and working out toward the waste on both sides. The purpose is to maintain a balance

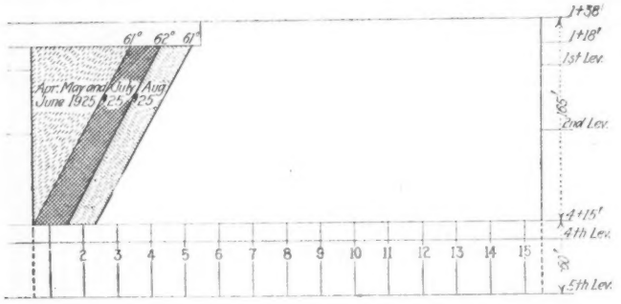


Fig. 16—Composite section through 4-34 Stope

between the waste capping in the two stopes by drawing the ore between the two, without the waste from either breaking through and flooding the chutes.

If the undercutting and drawing are properly done, a chimney of waste will be very rare. Sometimes an old raise in the area being drawn will start a flow of waste. In such a case the chutes that show waste are closed, as well as several chutes adjoining. The drawing proceeds around these chutes that have been closed until the waste has all been cut off, and later these chutes are reopened, starting from those farthest away from the chimney and gradually closing in on the center. The chutes that first showed waste will soon run ore.

Drawing is stopped and the chutes are sealed when a certain grade is reached. The minimum grade in each stope is changed from time to time and is based upon the total cost of producing copper for that stope, as well as the selling price of copper.

Charts are made for all caving stopes, and a few of these charts are presented here, which show the position of the angle of retreat for various stopes, at the end of each month.

1-48 Stope—The composite section in Fig. 12 shows the angle of retreat to have an average of 60 deg. Morenci timbered slides were used in this stope, and the lift was about 55 ft.

A-38 Stope—The average angle of retreat in this stope, shown in Fig. 13, was about 69 deg., increasing to nearly vertical at the finish where no end shrink was driven. Morenci timbered slides were used, and the lift was from 70 to 100 ft. This stope was heavy on the timbers; hence the angle of retreat had to be carried steeper than 60 deg. to keep the stoping area at a minimum.

A-48 Stope—The average angle of retreat in this stope, shown in Fig. 14, was 69½ deg. The Miami caving system was used with a lift of about 55 ft. This stope was heavier than the 1.48 stope, and therefore the angle of retreat was steeper.

A-54 Stope—See Fig. 15. The average angle of retreat was 70½ deg. The Morenci block cave system was used with flat undercutting. The lift was about 90 ft. This stope has been quite heavy at times, and shallow transverse shrinks were run at the front of the undercut area to cut down the weight by reducing the stoping area. The angle of retreat was kept steep to relieve some of this weight.

4-34 Stope—See Fig. 16. The average angle of retreat was 61 deg. The Morenci block cave system with rooms and pillars was used, and up to date practically no weight has developed; hence the angle of retreat has been kept close to 60 deg. The lift is now about 140 ft., but farther along it will increase to 200 ft.

The drawing unit is generally three motor cars of ten tons' capacity each. The chute checker furnishes the motor crew with a list of chutes as filled and directs the "pulling" of these in the proper sequence. A constant and accurate measure is thus provided for the grizzly men above.

Dilution—The following data show the dilution for all caving stopes, in operation this year:

Date	Expectancy Tons	Expectancy Grade	Extraction Tons	Extraction Grade	Per Cent Extraction Grade	Per Cent Extraction Tons	Per Cent Cu	Per Cent Dilution
Eight Months, 1925	603,345	2.10	728,031	2.00	95	121	115	5

This has been calculated by the method in use at the Ruth mine, the formula for which is:

$$\text{Dilution Tonnage} = (\text{Extraction Tonnage}) - \frac{\text{Expectancy Tonnage} \times \text{Per Cent of Copper Extracted}}{100}$$

$$\text{Per Cent Dilution} = \frac{(\text{Dilution Tonnage})\ (100)}{\text{Extraction Tonnage}}$$

This apparent dilution of 5 per cent is not the final figure for any given block. It is an intermediate average between stopes just starting, where there is no dilution, and stopes in the later stages of production, where there is a maximum dilution.

Operating Statistics

The following summaries were compiled by totaling and averaging the data from all stopes using these systems. Inasmuch as both systems, as at present developed, are comparatively new, it is felt that with additional experience these figures will be improved.

Data from Stopes Using Morenci Timbered Slide

	Tons	Per Cent of Total Stoping	Board Feet of Timber per Ton	Pounds Powder per Ton	Tons per Man
1925 January to August (inclusive)	413,147	46.38	2.07	0.46	17.72
Year 1924	360,172	38.16	2.10	0.40	16.29

Data from Stopes Using Morenci Block Cave

1925 January to August (inclusive)	357,626	40.14	0.81	0.33	21.80
Year 1924	125,743	13.32	1.60	0.54	12.39

The cost of repairs with the Morenci slide system is less than $0.05 per ton, and with the Morenci block cave system it is about $0.02 per ton.

The preparatory development costs per unit of horizontal area for the Morenci timbered slide is 42 per cent less than that for the Morenci block cave. The comparative cost per ton for this development work is greatly in favor of the Morenci block cave method because of the higher lifts used in the latter system.

The present development of these systems is due in a large measure to the many valuable suggestions offered by the men on the job. Improvements will no doubt be made in the future, through the continued active co-operation of these same men.

The writers are indebted to G. F. Carr, chief engineer for the Morenci mining division of the Phelps Dodge Corporation, and to the technical staff for their valuable assistance in preparing this article.

Mine Taxation in Montana

Properties Assessed at $5 per Acre Plus Improvements—Net Proceeds at 100 Per Cent—Also License Levy Based on Production

By M. B. Milligan
State Board of Equalization, Helena, Mont.

M. B. Milligan

AT THE TIME Montana was admitted into the Union as a state its only industries worthy of mention were mining and stock raising, with mining greatly predominant; but with the coming of the farmer agriculture gradually encroached upon this leadership. Its production in 1924 was valued at $89,601,000 against a metal production of $55,333,000; livestock, $38,580,000; lumber (including manufactured lumber), $13,000,000; coal, $10,000,000 and oil, $3,500,000.

The total state tax in 1917 was $22,950,000. In 1924 it was $26,982,886. School expenses accounted for more than half of the increase, and county, city, and town taxes accounted for the rest. The peak has been reached, however, and a gradual decrease in the per capita tax is to be expected.

In respect to mine taxation, Section 3 of Article 12 of the State Constitution reads as follows:

"All mines and mining claims, both placer and rock in place, containing or bearing gold, silver, copper, lead, coal or other valuable mineral deposits, after purchase thereof from the United States, shall be taxed at the price paid the United States therefor, unless the surface ground, or some part thereof, of such mine or mining claim, is used for other than mining purposes, in which case said surface ground, or any part thereof, so used for other than mining purposes, shall be taxed at its value for such other purposes, as provided by law; and all machinery used in mining, and all property and surface improvements upon or appurtenant to mines and mining claims which have a value separate and independent of such mines or mining claims, and the annual net proceeds of all mines and mining claims, shall be taxed as provided by law."

Though all property, for years, was supposed to be assessed at its full cash value, prior to 1919 it was actually assessed at percentages varying from 30 per cent on land to 65 per cent on bank stock, with an average assessment for the state as a whole of approximately 40 per cent. About the only property assessed at 100 per cent was the annual net proceeds of mines.

Taxable Property Divided Into Seven Classes

In 1919 a temporary "Tax and License Commission," which functioned during 1917 and 1918, recommended to the legislature a system of property classification which was promptly enacted into law. Under the provisions of this law all property is assessed at full cash value, and is divided into seven classes. Taxes are figured on a specified percentage of the assessed valuation of each particular class of property as follows:

Class I includes mining claims and net proceeds of mines. Taxes are assessed against 100 per cent of the full and true value of this class.

Class II includes household goods and furniture, agricultural and other tools, engines and boilers, automobiles and other power-driven cars, vehicles of all kinds, boats, and water craft. Taxes are assessed against 20 per cent of the full and true value.

Class III includes livestock and all agricultural products; stocks of merchandise and furniture and fixtures used therewith. This class takes a 33⅓ taxable valuation.

Class IV includes all land, city and town lots, with improvements, manufacturing and *mining machinery, fixtures, and supplies* except as otherwise provided by the constitution. Taxes are assessed against 30 per cent of the full value.

Class V includes all moneys and credits, secured and unsecured. The valuation for tax assessment is 7 per cent of its full value.

Class VI includes National bank stock and the moneyed capital of other banks, and has a taxable valuation of 40 per cent of its full value.

Class VII includes all property not listed in the six preceding classes, and takes a taxable valuation of 40 per cent of the full and true value.

This basis averaged for the state makes the taxable valuation about 31 per cent of the assessed valuation.

The immediate result of the initiation of this system was to raise the assessed valuation of the state and reduce the *taxable* valuation. At the same time, due to the increase in the assessed valuation, the state general fund levy dropped from 2½ to 2 mills (a constitutional provision). Counties, cities, towns, and school districts, though restricted to certain maxima, could and did raise their levies to counterbalance the decreased taxable valuation, but the state general fund, which supports the state schools and other institutions, found itself considerably "short-changed" and slipped rapidly into the red. To remedy this situation a popular referendum in 1920 authorized an additional 1½ mill general-fund levy, the proceeds to be used for the support and maintenance of the state university and allied schools. In addition, the 1921 legislature enacted a series of license tax laws: 1 cent per gallon on gasoline refined and sold in the state, and on gasoline imported and sold; 5 cents per ton on all coal mined in the state and on coal imported and sold; 1 per cent of the value of crude oil produced; 4 cents per barrel on cement; and a metal-mines license tax amounting to 1½ per cent of the annual net proceeds. The next legislature doubled the oil and gasoline taxes, and in the fall of 1924 an initiated measure imposed a new license tax on the metal mines in lieu of the 1½ per cent of net proceeds. The new measure taxes the producer on a sliding scale according to the value of his gross production.

Table I—Metal-Mine Assessments in 1923 and 1924 by Counties

Showing Total Taxes Levied and Amount Levied Against the Mines
(Taxable Valuations Only Are Shown)

	1923							1924						
	Assessments					Total Taxes Levied in County	Levied Against Mines	Assessments					Total Taxes Levied in County	Levied Against Mines
County	Mining Claims	Machinery	Improvements	Net Proceeds	Total			Mining Claims	Machinery	Improvements	Net Proceeds	Total		
Beaverhead	$34,023	$2,618	$83,500	$6,671	$126,812	$378,483	$5,843	$33,839	$1,365	$84,000	$14,029	$133,233	$361,407	$6,517
Broadwater	33,030	6,918	3,500	207	43,655	234,427	2,033	30,873	37,025	1,549	.....	69,447	199,357	3,159
Cascade	28,299	78,331	56,270	64,894	227,794	1,382,696	9,658	28,522	81,045	60,315	19,449	189,331	1,237,930	7,064
Deer Lodge	33,176	17,106	7,556	16,123	73,961	375,923	2,908	33,675	16,290	6,900	10,127	66,992	372,902	2,622
Fergus	29,611	8,736	18,180	642	57,169	1,146,068	2,635	33,622	.....	15,986	18	49,626	1,262,252	2,824
Granite	69,273	64,407	32,668	52,258	218,606	191,131	10,969	69,132	74,010	36,030	209,258	388,430	190,440	19,844
Jefferson	176,711	71,943	38,212	30,229	317,095	296,587	13,346	173,791	60,841	58,500	2,528	295,660	222,470	11,811
Judith Basin	13,000	17,398	15,750	322	46,470	357,443	1,941	12,545	17,106	15,750	.....	45,401	349,859	1,934
Lewis and Clark	90,025	29,727	54,390	7,647	181,789	781,854	8,066	89,705	18,069	48,372	150,250	306,396	739,232	13,245
Lincoln	17,650	73,732	22,938	.....	114,320	371,013	5,896	19,645	84,750	23,550	.....	127,945	355,903	6,421
Madison	81,967	41,305	16,400	6,485	146,157	317,269	7,202	81,522	32,125	15,862	209	129,718	283,078	6,281
Meagher	12,580	.....	.....	.....	12,580	198,646	518	14,285	.....	.....	.....	14,285	180,398	565
Mineral	18,105	11,062	750	410	30,327	200,891	1,424	18,105	9,030	750	.....	27,885	196,589	1,352
Park	27,860	6,375	19,950	3,981	58,166	406,542	2,411	27,570	13,971	27,150	.....	68,691	392,390	2,913
Phillips	3,380	3,000	6,150	99,070	111,600	465,624	7,326	3,383	750	2,775	19,253	26,158	459,048	1,791
Powell	41,073	.....	240	297	41,610	299,122	1,673	41,044	.....	240	439	41,723	267,073	1,758
Ravalli	16,545	.....	.....	.....	16,545	503,490	1,051	16,545	.....	.....	.....	16,545	445,619	994
Sanders	3,449	150	500	94	4,193	457,545	231	5,105	150	507	97	5,922	415,103	325
Silver Bow	159,790	3,641,457	1,276,568	4,895,935	9,973,750	1,817,551	485,422	162,080	3,261,486	1,061,550	5,040,714	9,525,830	1,685,289	464,670
Stillwater	2,734	.....	.....	.....	2,734	410,822	162	2,734	.....	.....	.....	2,734	377,513	188
	892,281	4,074,265	1,653,522	5,185,265	11,805,333	10,593,927	570,715 (a)	897,719	3,738,013	1,459,849	5,456,371	11,531,952	9,993,852	556,278 (b)

(a) This is 5.39 per cent of total taxes levied in these counties. (b) This is 5.57 per cent of total taxes levied in these counties.

The following gives the essential details of mine assessment and taxation at the present time:

Mines are assessed by the county assessors at $5 per acre, and on improvements and machinery of all kinds. If the surface ground has a separate and independent value for some other purpose, it is assessed at its full value for such other purpose. Net proceeds are assessed by the State Board of Equalization, such assessments being based on verified statements filed with the board by the producer, and allocated to the counties in which the mines are situated. The taxable value of the $5 per acre assessment and the net proceeds assessment is 100 per cent of the full and true value. The taxable value of the machinery, structures, and appurtenances is 30 per cent of the full and true value. These assessments all take the regular levies applicable to the taxing district in which the property is situated.

Table II—Segregation of Assessments—1923 and 1924

Showing Percentage of Each Kind of Property to Total Assessment
(Taxable Valuations Only Are Shown)

	1923		1924	
	Taxable Value	Per Cent to Total	Taxable Value	Per Cent to Total
Rural real estate and improvements	$205,194,916	43.97	$191,425,492	43.38
City and town lots and improvements	74,174,667	15.90	73,320,734	16.61
Public utilities (State Board of Equalization and Assessments)	102,278,293	21.91	93,883,133	21.28
Livestock	19,596,227	4.20	17,851,739	4.05
Personal property	53,590,316	11.49	53,261,713	12.07
Metal mines	11,805,333	2.53	11,531,952	2.61
Totals	$466,639,752	100.00	$441,274,763	100.00

In addition to the above, metal producers are subject to the payment of a license tax based on gross production.

The foregoing comments and data refer to the metal mines only. To show the magnitude of the mining industry as a whole, which of course includes smelters, reduction works, coal mines and like property, Table III has been prepared.

Net Proceeds Defined

Net proceeds, as defined in the law, is "The amount left after deducting from the gross yield of each mine in dollars and cents the following":

a. All moneys expended for necessary labor, machinery, and supplies needed and used in the mining operations and developments.

b. Actual cost of improvements, repairs, and betterments necessary in and about the working of the mine.

c. Actual cost of repairs and replacements of the milling and reduction works used in connection with the mine.

d. All money expended for transporting the ores, mineral products or deposits from the mine to the mill or reduction works or to the place of sale and for extracting the metals and minerals therefrom.

e. Actual cost of marketing the product and converting the same into money.

f. Depreciation in the sum of 6 per cent of the assessed valuation of the milling and reduction works used in connection with the mine for the calendar year covered by the statement.

The expenditures must not include moneys invested in the mines and improvements during any year except in the year covered by the statement, nor shall they include the salaries, or any portion thereof, of any person or officers not actually engaged in the working of the mine or superintending the management thereof.

The license tax is based on the market value of the metals produced, and is payable annually into the state treasury. The amount is determined by the State Board of Equalization from verified reports filed by the producer, and in this connection the board has authority to examine the books of smelters and reduction works if it deems such examination necessary or advisable. In arriving at the market value of the metals, average quotations in *Engineering and Mining Journal-Press* are used as a base, and from these average prices an equitable amount is deducted to determine the "Montana value." The same average prices govern all assessments. Under this new law the producers will pay approximately $400,000 this year, against $78,073 in 1923 and $82,102 in 1924.

Table III—Valuation of the Mining Industry as a Unit

	1923			1924		
	Taxable Value	Per Cent to Entire State Valuation	Taxes Paid	Taxable Value	Per Cent to Entire State Valuation	Taxes Paid
Reduction Works and Smelters	$8,507,206	1.82	$351,676.36	$8,464,435	1.92	$330,812.56
Mines, Machinery and Improvements	11,805,333	2.53	570,715.00	11,531,952	2.61	556,278.00
Other property	7,659,787	1.64	382,989.35	7,687,614	1.74	384,380.70
Totals	$27,972,326	5.99	$1,305,380.71	$27,684,001	6.27	$1,271,470.26

In the tables submitted with this article *taxable* valuations only are shown. Assessments shown as "mine assessments" are strictly metal-mine assessments, and

do not include net proceeds and other assessments pertaining to coal mines or the oil industry, nor do they include assessments of the American Smelting & Refining Co. on its plant at East Helena, or the smelters of the Anaconda Copper Mining Co. at Anaconda and Great Falls. These plants are not assessed as "mining property," but are included in Table II under real-estate and personal-property assessments.

Of the fifty-six counties in Montana only the twenty shown contribute to the metal output. Table I segregates mine assessments for 1923 and 1924, and gives a further segregation by counties. It also shows the total taxes levied in each county (exclusive of city or town taxes) and the amount levied against the mines. Table II gives a segregation of the entire state assessment for 1923 and 1924, with the percentage which each kind of property bears to the total assessment.

If the new license tax law should be successfully attacked in the courts, the defects brought to light will, without question, be remedied at the earliest possible date.

"Other Property" includes timber lands and coal properties, farm lands used in connection with the disposal of tailings and other smelter waste, town lots for office, boarding house and similar purposes, and the Butte, Anaconda & Pacific Railroad used for hauling ore from the Butte mines to the smelter at Anaconda. The taxes paid on this property are estimated. The amount is higher in proportion to the taxable value for the reason that much of the property is in taxing districts having a higher levy than the districts in which the reduction works and mines are situated.

Many Uses for Diatomaceous Earth

Large deposits of comparatively pure diatomaceous earth exist in various parts of Nevada, but the profitable mining and marketing of the material is at present limited to the production of small quantities for local consumption and to the shipment of small lots for miscellaneous uses, according to the U. S. Bureau of Mines. That consumption is only local is due to the occurrence of large deposits elsewhere of diatomaceous earth more favorably situated with regard to transportation facilities and markets, and to the competition of producers who have highly specialized plants in operation.

The Bureau suggests three fields in which the consumption of diatomaceous earth is sufficient to consider them as outlets for the Nevada material. These are the building trades field, production for use as insulation, and production for use in filtration.

Diatomaceous earth, the Bureau states, consists almost entirely of the siliceous remains of minute aquatic plants known as diatoms. Its most important industrial application is as filtering and clarifying material. The consumption for this purpose is large, and although the material must be comparatively pure and requires special preparation, its price is sufficiently high to stand shipping to distant points.

A second extensive use for this material is as an insulator for steam and water pipes, boilers and the like. This field is at present being greatly enlarged, as the economy effected by using diatomaceous earth is beginning to be more widely appreciated, due to educational advertising. Although crude material requiring little preparation may be used in many cases, its selling price is so low that it cannot be profitably shipped.

Other uses for diatomaceous earth, which are of only local importance or which consume relatively small amounts of material, are: As building material, as a filler, an abrasive, absorbent and as a chemical reagent.

As a filtering, clarifying, and decolorizing agent, diatomaceous earth is used extensively in the preparation for market of sugar, oils of many kinds, and numerous other products. It is used to remove mould and ferments in wine and beer, in bacteriological and laboratory filtration, and in preparing serums.

As a building material, diatomaceous earth is used in blocks, pulverized, or compounded. As a filler, it is used in soft and hard rubber, phonograph records, sealing wax, match heads, the coating on match boxes, soaps, paint, paper, papier maché, oilcloth, linoleum, curtain cloth, fire-proofing, calsomine, roofing, drugs, and in plastics wherever a light, cheap, inert filling agent is desired. As an abrasive, the material is used as polishing and cleansing powder for metals, glass, furniture, bath tubs, sinks, finger nails, and teeth, and for polishing metal for microscopic examinations.

Diatomaceous earth is also used as an absorbent for liquid disinfectants, liquid manure, waste sulphite liquor, and as a vehicle for holding oxides of nickel and other metals for catalysts. As a chemical reagent, it is employed in the manufacture of sodium silicate, and as a body for ultramarine, aniline and alizarine colors, and for making casein glue and pure silica.

Copies of Serial 2718, containing the report of this investigation, may be obtained from the U. S. Bureau of Mines, Department of Commerce, Washington, D. C.

New Markets Possible for Canadian Asbestos

Announcement has been made by persons interested in the Canadian asbestos industry regarding some important tests recently conducted at the brake lining plant of the Asbestonos Co. at East Broughton, Quebec. These tests, it is said, show that properly prepared Canadian asbestos may be able to compete successfully with fibers from Rhodesia and South Africa. The latter countries have made important inroads in recent years on the markets for Canadian asbestos, particularly for crude and spinning fibers. Sales of asbestos from the African fields have grown to a point where they amount in value to 50 per cent of the Canadian output.

The tests described were made with asbestos produced by a new "selective treatment wet process." It is stated that they showed that less costly fiber, produced by the wet process, may be utilized for spinning, giving a cleaner, stronger yarn than was obtained with the more expensive dry-process fiber. In the tests, the manufacturers state, the manufacturing loss amounted to only 7 per cent, as compared to the usual loss of 25 per cent, and the breakage of the yarn on the mules was much less than heretofore. Owing to this and the fact that less costly fibers could be employed, it is said, the saving in manufacturing cost was about 68 per cent. Breaking tests on this yarn, recently completed at Montreal, show that the yarn produced with wet-process fiber was approximately 50 per cent stronger than similar yarn made with the dry-process fibers. As practically all the fiber from the African fields is shipped as crude or other costly fibers, the tests suggest that the application of the wet process to Canadian asbestos would effectively shut out the African fiber both in Europe and the United States.

The Proper Use of Lime to Alkalize Mill Circuits

Quantity of Water Used for Slacking Has Important Bearing on Physical and Chemical Characteristics of Product

By Clark T. Henderson
Great Western Electro-Chemical Co., San Francisco

ALTHOUGH it is difficult to lay down hard and fast rules for flotation, each ore being a problem of itself, still, certain underlying principles are worthy of consideration.

Xanthate is not, contrary to the view of some, a frothing agent, and cannot, therefore, supplant oils in flotation work. Rather it is a conditioning agent making the ore more amenable to the action of the froth produced by the oil in the flotation circuit. The type of oil which will give best results with xanthate must usually be determined by experimentation, some classes of ore yielding higher-grade concentrates and better recoveries with the aid of steam-distilled pine oil, whereas others will show best results with hardwood creosote and still others with cresylic acid. Xanthate will give good results in acid circuit, but it seems more satisfactory in alkaline circuit, and the advantages of flotation in alkaline rather than in acid circuit are usually such as to make the alkaline circuit preferable, even though metallurgical results in both are the same.

Alkalinity can be best secured with the aid of lime, as is done in cyaniding, the quantity required varying in practically every instance. The question often arises as to whether calcined dolomite may not be substituted for strictly calcium lime for flotation purposes: there is but one answer, and that is the negative. The reason for this is that the lime, to be effective, must go into solution in the pulp, and magnesium hydroxide is scarcely soluble in water, so that if a dolomitic lime is used, only the calcium hydroxide contained is useful for flotation purposes and much larger quantities must be employed.

Lime Has Peculiar Characteristics

Though lime is one of the commonest chemicals and seemingly one of the simplest, it has peculiar characteristics worthy of serious consideration in using it in flotation. As already stated, the calcium hydroxide must go into solution to be effective. A part of the lime which goes into solution is consumed in neutralizing the temporary hardness of the water used in making the pulp; more of the lime is consumed in neutralizing such acidity as there may be in the ore, and the balance creates the necessary alkaline condition in the circuit.

It is common practice in some plants to feed lime into the flotation circuit as dry quicklime, or calcium oxide. If fed thus, the conditions under which the quicklime will slack are quite uncertain, and the conditions under which the lime is slacked have a distinct bearing on its effectiveness in the flotation circuit. Other plants use hydrated lime, which is quicklime slacked with the theoretical amount of water required for hydration. This hydrated lime is either fed dry into the flotation circuit or is mixed with water to form milk of lime, which is then fed into the circuit. Still other plants make a practice of slacking quicklime with uncertain quantities of water, then making up a milk of lime of uniform strength for feeding into the flotation circuit.

A comprehensive series of experiments that were conducted in our company's laboratory gave the following results:

Where a certain amount of quicklime was slacked with the theoretical amount of water required for hydration; this hydrated lime then diluted with additional water to a standard volume; and this standard volume of milk of lime placed in a graduated cylinder, thoroughly agitated, and allowed to settle, the time required for the undissolved material to settle to 50 per cent of the total volume of the original milk of lime was ten minutes. A corresponding sample of quicklime was next taken and slacked with ten times the theoretical amount of water required for hydration. This was then diluted to standard volume, placed in a graduated cylinder, thoroughly agitated, and allowed to settle. The time required for the solids to settle to 50 per cent of the original volume was in this case 440 minutes.

Excess of Water Gives Lower Settling Rate

It was obvious from the foregoing and other experiments that lime slacked with not less than ten times the theoretical amount of water is much slower settling and consequently much easier to hold in suspension in the feed tanks, and has less tendency to settle out in the flotation circuit, than a milk of lime made of hydrated lime, or quicklime slacked with small quantities of water.

Having thus proved that an excess of water gives a milk of lime having a lower settling rate, experiments were next undertaken to determine the relative chemical activity of these two types of milk of lime. Each sample of milk of lime was thoroughly mixed with the theoretical quantity of sodium carbonate that would react therewith to form calcium carbonate and sodium hydroxide. The relative time required for causticizing was taken as an index of the relative chemical activity of the two types of milk of lime. The milk of lime which settled in ten minutes was found to require 330 minutes to effect complete causticizing of soda ash mixed therewith, whereas the milk of lime requiring 440 minutes to settle was found to react completely with soda ash in five minutes.

The foregoing experiments seem to prove beyond question that the proper type of milk of lime to use in flotation work is one made by slaking high-calcium quicklime with not less than ten times the theoretical amount of water required for hydration, because a milk of lime so made is not only slow settling but much more active in a chemical sense. The same conclusions would seem to apply to the use of lime to secure protective alkalinity in cyanidation.

In plants where large amounts of lime are used in flotation the best plan to follow would seem to be to slake the quicklime in a ball mill operating in closed circuit with a classifier, introducing into this ball mill not less than ten times the theoretical amount of water required for hydration. With this arrangement the larger pieces of quicklime would be crushed in the ball mill and thus made amenable to quick hydration, while any cores or other slow-slaking particles would be returned by the classifier to the ball mill, the overflow from the classifier being uniformly a slow-settling and highly reactive milk of lime which might not be secured by other means.

Mining Salt in Bavaria

By N. Tourneur
Thundersley, England

THE BERCHTESGADEN salt mine, in Bavaria, though neither the oldest nor the most important on the Continent of Europe, is unusual as regards the method, now generations old, of its underground transit. Probably in no other mine in the world is "tobogganing" used to such an extent. Unlike the famous salt mines in north Galicia, and others in Europe's great salt tract, the Salzkammergut, that lies in a semicircle from the southeast to the southwest of Salzburg, Berchtesgaden may be described as mostly a brine pit. In those others mentioned the rock salt is quarried in blocks. In the Berchtesgaden pit the salt is washed out of the earth and limestone, and obtained by evaporation. Some of the brine is boiled down near by in the valley; and some, piped over miles of mountain, brings employment to many folk in the town of Reichenhall.

Before entering the mine, the visitor is equipped in a miner's clothing: a pair of very wide trousers, an ample jacket, a felt hat with an excessively broad brim, and a leather apron. This last you are told to put on behind; and the reason for this is soon forthcoming. A lantern is handed to you, which the guide carefully inspects and lights. Then he ushers you into the mine.

The incline, cut through the solid rock, is only broad enough for you and the guide to walk in single file. The sides and roof of the galleries are timbered, and between the interstices the salt in the earth behind sparkles in the lantern light. As you go farther and farther unward into the mine, many disused side passages and exhausted chambers are passed, and the air gets colder. Pipes for the water used in the mining run alongside you.

Passages are driven through the limestone to the beds of salt, where a small chamber is cut out. Pipes are laid into this from above, and another set of pipes from it down to the valley. A system of valves regulates both sets and communicates with other systems and chambers. On the new working being filled with water, its roof and sides gradually crumble down, the salt dissolves, and the detritus sinks to the bottom. After two months or so, the chamber being kept full, the water is charged with salt. Tests for the strength of the brine are taken daily, and when sufficiently strong it is run out by means of the lower set of pipes into the tanks in the valley. The chamber is flooded repeatedly, until either it is exhausted or becomes unsafe. Meantime the brine is being evaporated in the salt pans.

After you have passed through several of the spent chambers, the cramped passage you are traversing ends on the brink of the "Salz See," an irregular sheet of briny water, 80 to 90 yd. in length and about 25 yd. broad. You can touch the roof of the cavern with your hand by standing on tiptoe. The guide unhooks his lantern from his belt, and waves it. A boat heaves into sight, and you are carried off into pitch darkness. Soon the craft begins to roll a little, and the lanterns show it is breasting a rapid stream in a low-roofed gorge. Here, many generations ago, a flow of water breaking down several chambers brought about the "Salz See."

By a long series of steps you mount to other galleries and chambers, climbing to where the rock salt is quarried. It is here tobogganing begins.

The *rolle* or toboggan is merely a long substantial low-wheeled board, on each side of which is a rounded piece of wood. It slants at an angle of 45 deg., and is controlled, when desired, by means of the guide or side rope on the right-hand side of the steeply inclining adit. Through the use of a thick leather glove on the right hand, the miner can brake the speed by holding more or less tightly to the rope. Usually he makes no attempt to slow down, and accidents occasionally happen.

You seat yourself on the *rolle*, making use now of the leather apron to sit upon; grasp the guide line with your gloved hand, and hold your lantern with the left. Your guide shoves off, and jumps on in front of you; and you find yourself hurtling downward. Almost instantly, the *rolle* is at the end of several shafts or galleries, and stops within a few feet of what appears to be an immense bottomless pit. Here and there in it lights flicker, and you hear the sounds of labor. Another toboggan takes you down into the underground quarry, where the rock salt is being cut out in pieces and loaded on *rollen* for conveyance to the plant outside. Berchtesgaden rock salt contains, however, a considerable amount of gypsum as well as several other natural adulterants.

14,000,000 lb. of copper stacked at Chile Copper Co.'s plant at Chuquicamata when railroad strike prevented shipments

Determining Dip and Strike Graphically

A Method That Is More Accurate Than That Involving Use of Compass and Clinometer—Field Work Requires More Time

By William Johnson Kemnitzer
Geologist, Bakersfield, Calif.

IN TAKING THE DIP and strike of strata, the larger the plane worked over the more accurate the result. From the relative position and elevation of three points not in a straight line, on a plane, the dip and strike may be graphically determined with greater accuracy than by obtaining the result directly from a compass and clinometer reading. By the usual method of obtaining the dip and strike, involving the use of a Brunton compass, only a small portion of the plane is considered, and in many cases the true attitude of the beds is not learned. When great accuracy is desired in making a geological survey, the graphic determination may be profitably used. The mathematics and descriptive geometry that it involves are simple, although the field work necessarily requires more time than that called for in making the usual direct reading with a Brunton compass. Following is the procedure to be followed in the field in gathering the necessary data called for by the graphic method:

1. Locate and determine the elevation of some point, called point 1, at a convenient distance from the plane of the visible stratum.

2. Determine, from point 1, the distance, direction, and elevation of points 2, 3, and 4, on the plane.

The only reason for first locating and determining the elevation of point 1 is to have a datum from which to work. Actually, only three points on the plane are used in the determination, but it is rarely possible to begin operations from a point that is directly on the plane.

The field work may be done in various ways; from the use of the pace, the Brunton compass and the hand level, to the use of the plane table and alidade, the manipulation and technicalities of which are not considered in this article.

From the data obtained in the field a figure may be plotted similar to Fig. 1*b*. The distances from point 1 to the points on the plane are variable: they may be several feet or several thousand feet, depending on the size of the plane under consideration. An effort should be made to select points 2, 3, and 4 in such positions that lines joining them will form, as nearly as possible, an equilateral triangle. Point 1 should be close enough to the points chosen on the plane to form large α and β angles.

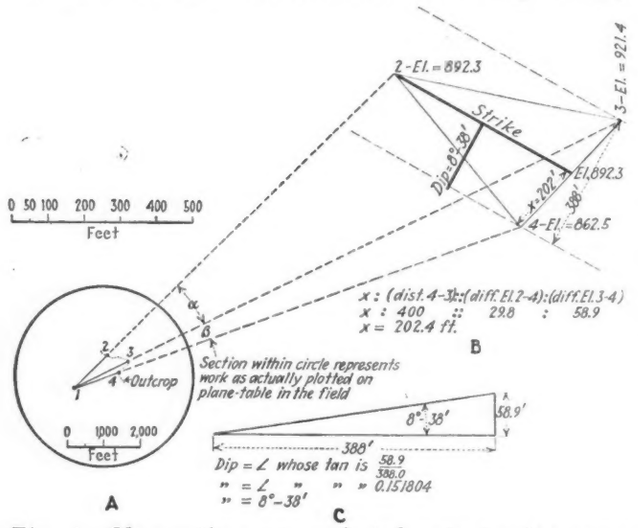


Fig. 1—Observations as projected onto tracing paper in determining dip and strike

Should the work be done with the plane table and alidade, the actual points, the lines adjoining the points, and the resulting figures may be very small, depending on the scale used. In such a case the work is plotted as shown in Fig. 1*a*.

The dip and strike is determined in the office by placing a piece of tracing paper over the four points as plotted in the field, and extending the lines 1-2, 1-3, and 1-4, several inches across the paper. (See Fig. 1, *a* and *b*). Plot the points 2, 3, and 4 by laying off on their respective lines, to any convenient scale, their recorded distances from point 1. Join the projected points 2, 3, and 4 by straight lines. The resultant triangle represents a section of the stratum in the horizontal plane, and from it the dip and strike may be determined. The scale used for any particular set of points may be any that will insure a large, clear triangle from which distances may be readily and accurately scaled.

By definition, the strike of a stratum is the bearing of a horizontal trace on the bedding plane. The dip of a stratum is the angle between a bedding plane and the horizontal, measured in a plane at right angles to the strike.[1] Therefore, a line from the point of intermediate elevation to a point of the same elevation on the line joining the highest and lowest points will be the strike. A line at right angles to this strike and in the direction of the lowest point will indicate the direction of dip.

To find where the point of intermediate elevation actually falls on the line joining the highest and lowest points is a matter of simple proportion. Referring to Fig. 1*b*:

X	:	(Distance 4-3)	::	(Difference of elevation 2-4)	:	(Difference of elevation 3-4)
X	:	400	::	29.8	:	58.9
X	=	202.4 ft.				

The distance from point 4 to point 3 is scaled from the drawing. Other proportions can be made to determine the strike.

To find the amount of dip, draw lines parallel to the strike through the points of highest and lowest elevation (Fig. 1*b*). Measure the shortest distance between these lines. The difference in elevation between points 3 and 4 represents the the inclination for this distance. Using the scaled distance as a base for a right-angled triangle (Fig. 1*c*), and the difference in elevation between points 3 and 4 for the length of the side opposite, the amount of dip is the angle between the hypotenuse and the base. Mathematically, the dip is the angle whose tangent is the "side opposite" divided by the "side adjacent" (base).

This method reduces the chance for error to a minimum and may be rapidly executed after a little practice with it.

[1]Willis, Bailey, "Geologic Structures," page 8.

Useful Operating Ideas

Repairing Concrete Foundations

By Charles Labbe

At times it happens that the base of a heavy piece of machinery will grind or wear its way into the concrete foundation, vibration being often the chief cause. This also occurs when the concrete is not of the best. There are several ways of correcting the difficulty, depending upon the extent to which the top of the block has been worn. If the wear is not too great, the base of the machine can be lifted enough to slip over the concrete one or two thicknesses of roofing paper which is soft and which will help make a better contact. In tightening the base the extra thickness will bring the machine more nearly back in line.

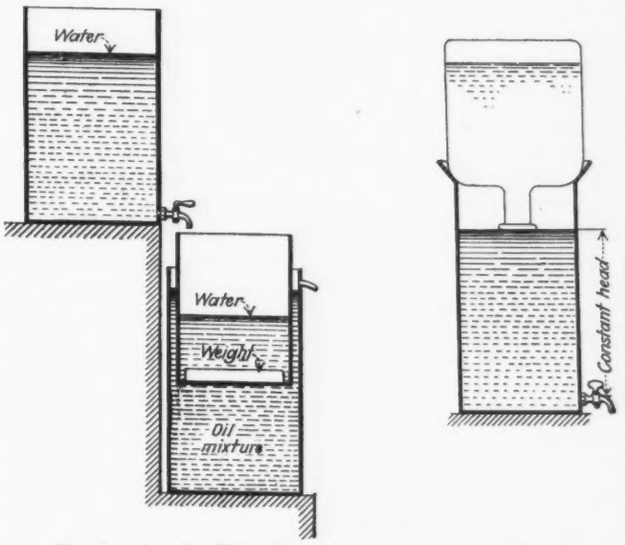
When the base has worked down into the concrete it is best to place a piece of sheet-iron with holes drilled into it corresponding to the foundation bolts. The plate should be as thick as possible without throwing the machine too much out of its position. Where the finishing layer of cement has been put on after the concrete has hardened, it will frequently break up after the machine has been in operation. Oil also seeps under the broken pieces, and when this happens it is useless to place a new grouting of cement, as it will not adhere to the concrete. The best method is to remove the broken top layer and then place a few layers of building or roofing paper to fill the roughness of the concrete. A plate of iron is then prepared and slipped in place, due caution being taken to keep the machine in its proper position. If the finishing thickness of cement mortar is not placed upon the concrete within twenty-four hours after the concrete has been poured, it is necessary to roughen the concrete to a fresh surface. Care is taken to keep the concrete wet while putting on the last coat or grouting.

Flotation Oil Feeder

By R. V. Thurston

In flotation it is necessary to have a regular and constant rate of flow of the reagent being used. There are several mechanical feeders on the market which give satisfactory service. However, it frequently happens that when one wishes to experiment with a different oil mixture an extra mechanical feeder is not available. Most millmen have tried to drip oil from a can fitted with a petcock and have found that it takes all of one man's time to keep the oil from dripping too fast or from stopping altogether. This difficulty has been overcome by the simple device shown in the illustration.

A receptacle fitted with a spout at the top contains the oil mixture. A second receptacle, slightly smaller in cross-section, is weighted with a little sand or a small, flat metal slug, so that it will float on top of the oil in an upright position. Water is then allowed to drip into the smaller can, and the oil mixture is forced



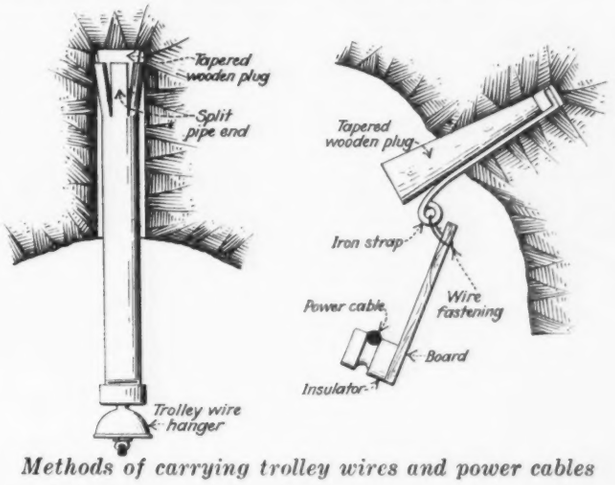
Device for feeding flotation oil at constant rate

out the spout by displacement. It is easy to regulate a petcock so that water will drip slowly and regularly into the can, and this insures regular feeding of the flotation reagent. In cold weather it is advantageous to use hot water, which will keep the flotation oil warm and aids in obtaining a regular feed.

[A convenient device for obtaining a constant head upon the water petcock is indicated at the right in the accompanying illustration.—EDITOR.]

Trolley Wire and Power Cable Hangers

At the Mason Valley Mines, Mason Valley, Nev., trolley wires are suspended from short lengths of 1½-in. pipe which are inserted in drill holes in the roof of the adit. The end of the pipe is split and a wooden plug inserted. The pipe is then driven into the drill hole, the wooden plug forcing the walls of the pipe outward. Drill holes are 18 in. in depth.

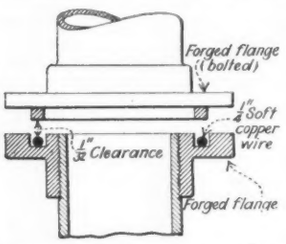


Methods of carrying trolley wires and power cables

Power and lighting cables are attached to insulators which are in turn attached to short lengths of board. The board is attached by wire to the eye of a short piece of iron, which is held by a wooden plug driven into a shallow drill hole as shown in the accompanying illustration. The hangers are placed 50 ft. apart and give satisfactory service.

Gasket for Vacuum Work

A type of gasket has been developed by the Shell Company for high vacuum work which has proved to be more satisfactory than all gaskets formerly used. The flanges are in pairs, one flange being provided with a ridge of rectangular section which fits into a corresponding groove upon the other flange. A clearance of $\frac{1}{32}$ in. is allowed between ridge and groove. A soft copper wire, $\frac{1}{4}$ in. in diameter, is joined by brazing so as to make practically a jointless ring. This is placed in the groove and is slightly flattened down by the pressure of the bolts of the flanges. The accompanying illustration shows the important features.



Construction of gasket for high vacuum work

Utilizing Old Drill Steel

By David R. Thomas

Obsolete sections of drill steel, short starters, broken shanks, and miscellaneous pieces can be utilized to good advantage in ball mills as grinding medium by cutting them up into short pieces of from 2 to $2\frac{1}{2}$ in. in length. The cutting can be done in a steel sharpener by removing the clamping dies and inserting cutters, which can be made by any blacksmith from old gaging blocks. The steel is heated in the same manner as for sharpening and then fed to the cutters.

Pieces of old rubber belt can be used to save the sharpener from too severe shocks. The steel when cut may be dropped in water and slightly tempered. Cutting once a week will keep the shop free of junk and will add materially to the stock of grinding medium.

Surveying Empty Stopes

To determine the approximate outlines of large empty stopes and underground chambers, a simple method has been worked out at the Mason Valley Mines, Mason Valley, Nev. An arc lamp of the small type used in metallographic work was adapted by removing the lense and substituting a metal plate in which was cut an opening of the section of a Maltese cross. The ray of light when directed against the wall of a chamber gave a light pattern of the same outline. Two transits set up on known points were used and simultaneous observations taken upon the light spot, vertical and horizontal angles being read. By a simple graphical construction the position and height of the light spot with reference to stope plan was ascertained. By finding a number of points in this way the approximate outlines of the exposed walls of the stopes were determined.

Determination of Zinc, Lead, Iron, and Cadmium in Slab Zinc

By John H. Hastings
Chemist, Donora, Pa.

Iron and Lead—Ten grams of zinc are weighed into a large beaker, 100 c.c. of water and 18 c.c. of sulphuric acid being added and solution taking place overnight. The solution is filtered off from the lead remaining undissolved and this is dissolved in 1:1 nitric acid. The filtrate containing the iron is titrated with potassium permanganate, 1 c.c. of which is equal to 0.005 grams of iron.

To the solution containing the lead 15 c.c. sulphuric acid is added and the beaker heated for one hour until dense white fumes are expelled. The solution is cooled and diluted to 100 c.c. with water; boiled, cooled, and filtered. The precipitate is dissolved in 15 c.c. saturated solution of ammonium acetate, diluted to 100 c.c. with water; brought to boil and titrated with solution of ammonium molybdate, using tannic acid (0.1 per cent solution) as an indicator. One cubic centimeter of the ammonium molybdate solution is equal to 0.005 gram of lead. On the dross zinc in which the lead is low, 10 c.c. of lead acetate is added to the determination just before titrating. One cubic centimeter of the lead acetate solution is equivalent to 1 c.c. of the ammonium molybdate solution. The 10 c.c. is then subtracted from final reading. This expedient makes it easier to get a good end point.

Cadmium—Twenty-five grams of zinc are weighed into a large beaker; 250 c.c. of water and 55 to 60 c.c. hydrochloric acid are added. After standing overnight nearly all the zinc is dissolved, but enough remains undissolved to prevent the solution of the cadmium. The solution is filtered off from the undissolved portion, which is then dissolved in dilute nitric acid and evaporated to a small volume, which turns red in color. Eight cubic centimeters of sulphuric acid is added and the beaker heated to dense white fumes. The solution is cooled, diluted to 30 c.c., boiled, cooled, and filtered. If the filtrate contains much cadmium, over 0.01 per cent, it is diluted to 500 c.c. with water and 50 c.c. removed. To the filtrate is added a bent piece of sheet aluminum about $\frac{1}{2}$ in. wide and shaped to form a triangle, the sides of which are about one inch long. The filtrate is diluted to 200 c.c. and boiled for ten minutes to precipitate the cadmium which is filtered off. The cadmium, aluminum, and paper are washed well, four or five times for the latter, and 5 c.c. nitric acid is run over the aluminum in the beaker, the solution being poured through the filter paper to dissolve the remaining cadmium. The aluminum and paper are washed three times and the filtrate is evaporated to dryness. The cadmium is dissolved in 5 c.c. hydrochloric acid, diluted to 200 c.c. and heated to 80 deg. C. Five cubic centimeters of 10 per cent solution of sodium hyposulphite is added and 20 c.c. of zinc chloride solution (1 c.c. of which is equal to .005 grams of zinc). The solution is titrated with a potassium ferrocyanide solution, 1 c.c. of which is equal to 0.005 gram of zinc, using 5 per cent solution of uranium nitrate as indicator. If copper is present it is precipitated on granulated lead, before titrating, by boiling.

Zinc—The zinc is taken as the difference between 100 per cent the total of the lead, iron and cadmium.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Moralistic and Scientific Cerebration

THE EDITOR:

Sir—Judging from R. B. Brinsmade's article, "Do Engineers Fear To Be Statesmen?" and other articles appearing in *Mining Journal-Press* from time to time on the same subject, engineers are having quite a time explaining why "lawyers are everything and engineers nothing in the leadership of public opinion on social and economic subjects." The most noticeable thing in all this discussion is the quite general contention of engineers that "engineers are mentally more competent than the members of any other profession to solve general economic and industrial problems." In this they are very much like the scientists, who also admit that they are a great deal more competent to solve our social problems than the statesman. As an example of the scientist's claim read Wiggam's book, "The New Decalogue of Science."

Though scientists and engineers may be thoroughly convinced of their superior ability to solve our social problems, there are a few men who are not so certain about it. Some time ago in an article, in the *Century*, Lincoln Steffens stated that the scientist thinks scientifically about chemistry, biology, and physics, but thinks moralistically about politics, business, and life. "When a mayor or a governor goes wrong, the professors, like the rest of us, ask for a good man for mayor, and when there's war they want to kill the Kaiser, all of them, each on his side. Virtue is the cure for the evil effects of bad economic forces."

MERE SUBSTITUTION OF INDIVIDUALS FUTILE

According to this we wouldn't better matters much by substituting scientists or engineers for statesman, for they as well as he reason moralistically when it comes to questions of politics and economics. According to this, the solution of our economic and political problem is not a question of substituting one class of men for another class, but of reasoning scientifically instead of moralistically. It is a question of helping the statesman, who is charged with the solution of our social problems, to reason scientifically about them. A discussion of a question like this may not under some circumstances be considered within the sphere of a mining journal, but as it may help define the engineer's position in the general scheme of things, and keep him from needlessly interfering in matters that another is charged with and keep him, also, from neglecting his own business, it may not be out of place to discuss it here, as we may understand things a little better if we know something more of what is meant by scientific and moralistic thinking.

We reason moralistically when we explain our troubles as being due to bad men and fools, when we reason in terms of good and bad men, smart men, and ignorant men. Reasoning in terms of good and evil spirits is much the same. Thinking moralistically consists in mistaking effects for causes. Ignorance, selfishness, immorality, hatred, disease, and indifference are assumed to be causes instead of effects. And, of course, being causes, the remedy is to substitute the opposite. The cure for ignorance is education; the cure for being bad is to be good—is to be preached at; either that or eliminate the bad by hanging them or by the eugenic route. The cure for indifference is to become interested, and the cure for hatred is love.

FOLLY OF ACCEPTING EFFECTS FOR CAUSES

By mistaking effects for causes we find ourselves accepting and supporting such stupidities as the doctrine that all men are naturally bad, or that only some men are naturally bad, and that men do evil out of pure cussedness. Which all amounts to saying that men are bad because they are bad.

It should be remarked that no political or economic machinery, no matter how skillfully devised, can be made to work by immoral or insane men. This is generally recognized. In discussing our social problems there is a tacit assumption that men are moral and sane and will try to make any system work. There must be this assumption if we are to discuss these questions at all. It is shear idiocy to assume something that will make the solution of our social problems impossible. It is not a question of good men or bad men, smart men or ignorant men, but it is entirely a question of self-interest.

We reason scientifically about social and political questions when we reason in terms of self-interest, when we show that the evil men do is the result of their self-interest being directed into conflicting channels by a faulty political and economic machinery. Also, indirectly, by habits caused by following their self-interest under such machinery.

WHAT INTERFERES WITH STRAIGHT THINKING?

The question arises. Why do we think moralistically about economics and politics instead of scientifically? There must be a reason. The following, I think, is the correct explanation. Our system of property permits the ownership of the natural resources, which means, they being limited and there being no limit to the amount that can be owned, that some may possess them to the exclusion of others. This arrangement places men in a position where if they serve their own interests they must do so at the expense of others. If they don't seek possession they stand to be deprived of free access to them and thus must pay tribute to those who do possess them.

It becomes a question of you shall suffer ere I shall. There is no other alternative. It is in the very nature of the arrangement, and it is hard to see how

such a state of affairs can be any other than an everlasting source of trouble.

An almost identical condition is produced by our voting systems. By majority voting—majority rule—men, in pursuing their self-interest, are forced, involuntarily, to act against the interests of others. Majority rule is a whole-hog or none proposition—you are either master or slave, ruler or subject. It is either your will or the other fellow's; there is no other alternative. Under these circumstances every man must strive for the upper hand. Picture to yourself the state of mind that must necessarily exist under such economic and political arrangements, thought to be fixed or beyond improvement. Under such conditions a man must be constantly on the alert and striving for fear of want. He must consider the success of another man as a menace to his prosperity. Under such a state of society what is one man's gain is another man's loss. It produces a condition of perpetual warfare. A man is either for or against you—friend or foe. A man is forced to consider his own cause most righteous when failure of it means suffering. He must think in terms of good and evil—he must think moralistically. He must act in these ways in his own self-interest, because the ways to act differently are blocked by a belief in the unchangeableness or perfection of our economic and political machinery.

"Quit Damning"

What we need to do is to quit damning and blaming our officials. We need to quit damning and blaming the citizen for his lack of interest, for his failure to go to the polls. We need to quite damning and blaming the capitalist for the advantage he takes of such faulty political and economic machinery. We need to quit damning and blaming men and blame instead the institutions that direct the self-interest of men into such channels that they must, unintentionally, injure others. It is a question of men vs. institutions.

The first step toward a solution of our social problems is to free the mind of that tight-minded insistence in the idea that our political and economic machinery is beyond improvement. It is this more than anything else that blocks progress. Nature moves as a whole—that is to say, ideas tend to build up systems in harmony with themselves. The strongest builds up a system that excludes all ideas that conflict with it. Though innumerable factors enter into the production of social phenomena, so much stronger are some of our ideas that they may, for practical purposes, be considered the causes of our troubles. So strongly entrenched and so tenaciously do we hold to some of our economic and political convictions that no idea that happens to conflict with them has any chance of gaining a foothold or even getting a hearing. Because it conflicts, it is condemned.

Though one may believe that our economic and political conceptions are fundamentally wrong, there is no need of demanding that we change them forthwith, but simply that all our ideas be submitted to examination. There must be a revaluation of all our ideas. There must be an unhindered discussion of them. We cannot too strongly insist on this. Man is so constituted that he cannot for long hold and act on something that he thinks or feels to be wrong. He must act on what he thinks is right. William Crocker.

Prescott, Arizona.

Oxygen-Making Apparatus

The Editor:

Sir—Our attention has been directed to the article entitled "Oxygen Making Apparatus Said to Infringe," pages 751-752 of the issue of Nov. 7 of *Mining Journal-Press*. As secretary-treasurer of the Gas Products Association, a national organization of oxygen producers, representing over fifty oxygen companies, with plants from coast to coast, I wish to register a vigorous protest at least to the inference which may be drawn from this article. Irrespective of the meaning which was intended, the article referred to lends itself to an interpretation both unfair and untrue, namely that with the type of plant known as the "single rectification column," it is impossible to produce oxygen of 99.5 per cent purity. This is not according to fact, and we can assure you that a number of our members who operate such plants are able not only to produce oxygen of 99.5 per cent, but are doing so regularly, and delivering oxygen of that purity or better. The members of this association produce oxygen of 99.5 per cent purity or better, day in and day out, and those having the single type of plant to which you refer are no exception to this rule.

It seems to us that in the best interests of your readers, many of whom are doubtless owners of the single rectification type of plants, as well as a large number who are their customers, you will promptly take steps to correct such an incorrect, misleading and untrue impression. Charles T. Allen.

Chicago, Ill.

Publicity

The Editor:

Sir:—

> "There comes a time to every man
> Some situation where he can
> Attain such fame that folks acclaim
> The very mention of his name.—"

I am reminded of that song of Bert Williams' of eight or ten years ago, by your comment in *Mining Journal-Press* of Oct. 31 on "The Mute, Inglorious Greelys." Bert Williams must have been an engineer, or at least, when asked as a small boy what he wished to be, must have answered, "I want to be a mining engineer," for he goes on to say, after recounting the various opportunities which he had had to achieve fame, particularly of the chance to capture an escaped circus tiger, as perhaps those who are familiar with the song may recall, "It's a wonderful chance for somebody to get a lot of notoriety. Yes, suh, somebody else—not me."

That seems to be the exact thought, though unexpressed even to themselves, of the U. S. Geological Survey concerning its Alaskan expeditions, or, indeed, of any of its work, and of almost every engineer. "It's a wonderful chance for somebody to get a lot of notoriety, but somebody else—not me." Bert Williams may have used sound judgment in saying, "Not me," when given the chance to capture the tiger, but that can hardly be said of the engineer who, with valuable experiences, an account of which, if published, would direct favorable attention toward him, neglects to seize his opportunity. A few years ago I was standing on the edge of an unusually steep dump in Central America with the chief electrician. "A poisonous place," he commented, "one drop will kill you." It can scarcely be

possible that the engineer believes such opportunities are "poisonous." On the contrary, instead of being grains of strychnine, they are "wee draps o' Scotch on a bra' wecht day."

No engineering problem has ever been found to be, in its entirety, a "textbook picture." A certain department of an enterprise, or a portion of it, may represent a problem of that type, but modifications in it are sure to be required to meet conditions existing elsewhere in the system so that the whole may run more smoothly; an involvement in one place may induce a simplification in another, and the reverse, but these changes must be so adjusted that the operation *in toto* will be simplified. Such is the usual condition, and the ingenuity with which the problem is approached and solved is the criterion by which the engineer is judged; and the best proof of its possession is the published account of the problem and its solution.

It should no more be needful to prove the value of publicity to the engineer, trained to hunt for and to make use of every condition that may have even but a modicum of bearing on the analysis of the problem at hand, than it is to prove to the mathematician that $2 + 2 = 4$, or to the chemist that $2H_2 + O_2 = 2H_2O$. But since it is so close at hand, let us turn to "Engineers of Note" in the back copies of *Mining Journal-Press*. Robert Allen Kinzie is the "Engineer of Note" of the Oct. 31 issue. On reading over his biography, we note that he received his big step ahead to the Alaska-Treadwell from F. W. Bradley, for whom he had worked; to whom, in other words, he had been fully advertised. Picking any other *Mining Journal-Press* that is handiest—it is the issue of Sept. 26—we find the biography of the new Provincial Geologist of Ontario, Alfred Granville Burrows. "An appointment to the geological staff was always a matter of serious concern to Dr. Miller (the Provincial Geologist who appointed Mr. Burrows to the staff), but knowing Burrows from the latter's college days, he had no hesitation in having him transferred." He owed his most significant advancement, it is evident, to the publicity which he had received in the eyes of Dr. Miller while at college.

In a discussion concerning engineers in politics, a correspondent[1] writes: ". . . with the exception of Woodrow Wilson, no one stands higher in the American life of the last decade than Herbert Hoover." Was Herbert Hoover, then, next to Wilson, the biggest man in America, or was he, instead, the most widely advertised? In the "Mirrors of Washington," a book of a few years ago, the author (anonymous) says that Hoover was the greatest exponent of the art of publicity in America. Governor Dern of Utah is a mining engineer; the Governor of Nevada is also an engineer, yet how many, outside of their respective technical societies, who know of them as engineers know that they are governors, or how many who know of them as governors know that they are engineers?

It is strange that engineers so consistently ignore the benefit of advertising as regards themselves, since such a disregard is contrary to the very concept of engineering. "An engineer," says Fay[2], "is one who carries through an enterprise by skillful contrivances." Yet in disregarding self-advertisement the engineer has grossly overlooked a "skillful contrivance" almost indispensable to the "carrying through of the enterprise" most important to himself, his ultimate success; he has overlooked an item necessary to the quickest solution of his problem.

It is here, in its neglect to announce and to advertise its work, that the Geological Survey and similar bodies fail, that almost all engineers fail. "They were sent to do the job, and they came back and reported it done; and are ready for the next assignment"; so reads the editorial. But doing the job was but a single phase of the enterprise, just as mining the ore is but a single phase; the ore or its metal must, finally, be sold, and the Geological Survey has failed to sell its "ore." In time it will publish its reports and issue its maps, but only those immediately interested will ever know of it. And when it needs another appropriation from Congress to carry on certain work it will be asked to explain to a committee how the last appropriation was spent. Just so, when the engineer begins to look for new connections, for whatever reason, he finds that, regardless of the success he has previously made, he is usually unknown in the new locality and must begin over from much nearer the bottom. Perhaps for the best description of this condition of neglect we can call on the language of our grade-school days. The mining engineer is bounded on the north by the mine, on the south by the mill, on the east by the smelter, and on the west by the refinery, and forgets that the whole continent of his industry is bounded by the ocean, his public. "His public" because the individualism of an industry recruits its own public and it would be folly to expend effort on a non-understanding group.

Perhaps, though, it may not be so strange as appears that they are so oblivious to publicity. Perhaps they all fully realize its value, but are so engrossed in their work that they do not heed it. I am inclined to think so. Engineering, in its requisites, groups the men who follow it into a class by themselves; essentially they are dreamers, men who are working primarily for the love of their work, not for a monetary gain; to quote an obscure poet, "they are doing the work they want to do, in the way they want to do it." Certainly one would never follow engineering with the sole purpose of making money; one would buy and sell rather than create.

Perhaps, too, there may be some who, though fully cognizant of its worth, are yet unable to advertise in a way that draws. To them I call the attention of these words of Abraham Lincoln: "If you would win a man to your cause, first convince him that you are his sincere friend. . . . On the contrary, assume to dictate to his judgment, or to command his action . . . and he will retreat within himself and close all the avenues to his head and to his heart. . . . Such is man, and so must he be understood by those who would lead him, even to his own best interests." Substitute, in so far as the engineer is concerned, "such is the public," or, "such is your prospective employer," and we have the very heart of the practice of publicity.

Let us hope that the new generation of engineers will more fully appreciate that advertising their work is part of their job. They probably will; one of our foremost mining schools has installed an optional course in engineering publicity with this thought in mind. Those of them who remain blind will be quickly outdistanced by their more far-sighted brethren; those of them who think they are too busy with the job in hand will soon begin to wonder why the "publicity seeker" has a better one.

SAMUEL G. LASKY.

Kennecott, Alaska.

[1] "Limitations of the Engineer," Djevad Eyoub, *Mining Journal-Press*, Oct. 24, 1925, page 662.

[2] Albert H. Fay, "A Glossary of the Mining and Mineral Industry."

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

APPROPRIATION bill abolishes assay offices at Salt Lake City, Utah, and Deadwood, S. D.—Senate and House Committees on Mines and Mining named—Pittman silver bill reintroduced authorizing purchase of 14,500,000 oz. of the white metal.

Michigan College of Mines asks for funds to study utilization of low-grade iron and copper ores—Electric pumps replace steam at Calumet & Hecla.

Flin Flon copper property to undergo extensive development in spring; supplies to be shipped to mine during winter.

Tri-State lead and zinc consolidation planned in which Eagle-Picher will be a factor.

Bingham Mines earn $550,000, largest sinse 1917.

Hassayampa Placer Gold Mining Co. to install modern steel dredge near Wickenberg, Ariz.—Platinum placer claims in Grand Canyon invalid—Chloride, Ariz., to have custom flotation mill; Two new mills for Oatman.

Teck-Hughes pays 5 per cent dividend—Argonaut reorganization completed—Nipissing's exploration work promising—Canadian Asbestos merger approved by shareholders.

Gold discovered in old Roman mines in Hungary—Russian Manganese and Lena Goldfields profitable to Soviet Government.

New 110,000-volt power line for Cœur d'Alene; Bunker Hill orebody good on No. 18 level.

Osage Indians Receive $29,422,800 Oil Royalties and Bonuses During the Fiscal Year

A total of $29,422,800 was paid to the Osage Indians of Oklahoma from royalties and bonuses on oil and gas produced on their reservation during the last fiscal year, the Interior Department has announced. This is the largest amount ever paid per capita to the Osage Indians, each share being $13,200.

A report on the oil operations of the Osage Reservation shows that 33,662,179 bbls. of oil was produced in the fiscal year of 1925, the royalties on both oil and gas amounting to $11,144,492.63. Approximately $8,278,308 was realized from bonuses paid by oil operators at public auction sales of the leases during the year.

Since February, 1915, the total oil production on the Osage Reservation has amounted to 229,740,799 bbls. and the royalties received by the Indians totaled $81,737,217.81, according to the report. During that time a number of sales of oil and gas leases have been held, bonuses for leases covering 594,307 acres of oil lands bringing in $94,448,505.78, while bonuses for leases covering 512,088 acres of gas lands brought $1,173,920.48. The total from bonuses on both oil and gas leases amounted to $95,622,426.26 since February, 1915.

Many of the oil leases are purchased on the deferred-payment plan, a deposit of 25 per cent being required on the day of sale and the remainder in three equal annual payments. The deferred payments bear interest at the rate of 5 per cent and are amply secured. The total amount received by the Indians from the oil and gas industry during that time amounts to $177,359,644.07.

The Osage Indian Reservation comprises approximately 1,500,000 acres of land. The approved tribal roll contains the names of 2,229 Osage Indians, and these members of the tribe share equally in the proceeds arising from the leasing of the Osage Reservation for oil and gas mining purposes. In the event of the death of an enrolled member his share goes to his heirs.

Two New Mills for Oatman, Ariz.

The four cyanide tanks for the new mill of the Gold Dust mine, at Oatman, Ariz., are in place and the plant will soon be ready to operate. The mill was first equipped for amalgamation treatment, but when tried out the recovery was too low. This occasioned the testing of other methods, and in the meantime fire destroyed the mill buildings and some of the machinery. After being re-financed, the company did some development work in the mine which opened up new orebodies, and preparations were then made to change the milling system over from amalgamation to cyanide.

Another new mill which has just been completed in the Oatman district is that at the Katherine East End mine. This plant has a daily capacity of 75 tons and is producing about $18,000 in gold bullion every ten days. The entire production is coming from development drifts and raises in orebodies already blocked out. The company's property consists of seven claims adjoining the Katherine property on the southeast and should contain the extension of the high-grade ledge of the Katherine mine.

College of Mines Asks for Funds to Study Low-Grade Copper and Iron Ores of Michigan

At the next session of the Michigan Legislature, Dr. W. O. Hotchkiss, president of the Michigan College of Mines, at Houghton, will request a budget sufficient to enable the college to begin a definite program of research into the iron and copper future of the upper peninsula of the state.

Only the higher grades of ore are being utilized, according to Dr. Hotchkiss, and the proposed research will seek to make use of the low grades. Geologists have determined, he says, that the rich iron reserves of the Lake Superior district will be exhausted in twenty years and Minnesota's output greatly curtailed.

Dr. Hotchkiss calls attention to the fact that the history of every mining community is the same and that the industry follows a normal curve. Production first increases and reaches its highest peak. Business expands with it and times are good in that particular community. When the mines have reached their highest peak a decrease comes, and business institutions, residences, and other property decrease in value. "Over half a million people in northern Michigan are dependent upon the industry," says Dr. Hotchkiss. "We can give ourselves and the whole district a vast amount of business profit if we give thought to the future."

The Michigan College of Mines and similar institutions, he states, have been turning out men well versed in the principles of mining and engineering. Graduates of the future, however, should be men also versed in using low-grade ores. A committee already has

been formed in the copper district to study the situation relative to copper, and a similar committee will be formed in the iron districts.

"It will take money and intelligence to solve this problem," says Dr. Hotchkiss. "The legislature must help. There isn't a minute to waste. It is not the problem of the mining companies alone. It is something that concerns the welfare of every person in northern Michigan and in fact every person in the state."

Chloride, Arizona, to Have a Custom Flotation Plant

A custom milling plant has been promised Chloride, Ariz., by F. C. Smith, secretary and manager of the Chloride Mining Co. The plant will be built by the Chloride company, a corporation which has been operating the Hidden Treasure mine for the last nine years. The new mill will have a capacity of 150 tons and will be so built that the addition of more grinding equipment will make it a 300-ton plant. It will treat lead-zinc ores by means of selective flotation. Output from the Hidden Treasure and other Chloride district mines will be treated. Construction work will start about the first of the year and will require about six months. W. B. Twitchell is president of the Chloride Mining Co.

Golden Chariot Mine Builds 150-Ton Flotation Mill

The Golden Chariot mine, operating in San Diego County, near Julian, Calif., will soon have a 150-ton flotation mill in operation. The mine is a gold property, with a large deposit of milling ore, showing exceptionally high-grade streaks at intervals. The mine is well equipped with machinery, and a rod mill is being installed in the mill.

As an experiment, the mill has been using stamps with amalgamation and concentrating tables, but will now be changed over to amalgamation tables followed by flotation cells of the Simpson Pneumatic type. Tests have shown that a good recovery can be made with this equipment, and within sixty days it is expected that the mill will be in full operation. C. A. Ferrin is president and general manager of the company.

Oil Discovery Reported in Mathews County, Va.

Mathews County (Va.) oil lands have been examined by Wilbur A. Nelson, state geologist, who took samples of oil, gas, and water from some of the several wells which recently came into being there.

Conditions were described as "encouraging" by Mr. Nelson, who is quoted as saying: "We encounter the old, well-known theory that there can be no oil on the Atlantic coastal plain. This theory, I think, is well founded and correct, but I am not prepared to say that it applies to Mathews County, which further investigation may show to be of peculiar formation, not at all like that generally encountered on the coast."

Lead and Zinc Consolidation Planned

The Underwriters' Land Co., one of the largest lead and zinc production properties in the ore-bearing sections of Missouri, Oklahoma, and Kansas, will be merged with the Consolidated Land & Zinc Co., Picher, Okla. John B. Swift, president of the Eagle Picher Lead Co., of Cincinnati, which owns the controlling stock in the Underwriters company, said that further enlargement of the Consolidated company probably would follow. The company has options on several mines and royalty interests valued at $2,500,000, he said.

Mr. Swift estimated that the merged companies would produce in 1925 zinc and lead valued at approximately $5,500,000. They operate fourteen mills and hold leases on 500 acres of land in northeast Oklahoma and southeast Kansas.

Failure to Use Safety Rope Results in Death

WILLIAM P. BROOME. an employee of the Empire Zinc Co., Canon City, Colo., was killed when he climbed into a bin without attaching the safety rope to his body. The crushed ore merely formed a crust over the top, there being a cavity in the center. When he stepped on it the ore gave way and he toppled into the cavity and was crushed to death beneath the ore. The safety rope, if used, would have saved him.

Hecla to Install Hoist on 2,000 Level

The Hecla Mining Co., of Wallace, Idaho, is placing a new hoist on the 2,000 level, which will be for service in the shaft or winze that has been sunk 800 ft. from that level and about half a mile east of the main shaft. This installation is for extensive development on the 2,400 and 2,800 levels, on both of which the main Hecla ore shoot has been crosscut from the winze and drifted upon to an extent that proves the continuity of the ore without change in grade or quantity, compared with the levels above. Extension of the main shaft will also soon be taken up. The new hoist that is to be installed was built by the Coeur d'Alene Hardware & Foundry Co., of Wallace. It has a rated capacity of 150 hp., a rope speed of 900 ft. per minute and a normal rope pull of 6,000 lb. The drums are 48 x 36 in., each drum holding 1,950 ft. of 1-in. wire rope.

New 110,000-Volt Power Line for Coeur d'Alene, Idaho

To meet the growing demand for electric power for mining in the Coeur d'Alene district, Idaho, the Washington Water Power Co. has announced the early construction of a new 110,000-volt transmission line into the district, 67 miles in length, at a cost of $1,000,000, which is scheduled to be completed by July 1, 1926. The Washington company practically controls the distribution of electric power in the district. The Montana Power Co. supplies the Federal Mining & Smelting Co., the Hercules Mining Co. and the Tamarack & Custer Consolidated Mining Co., but it operates in Idaho under a limited charter which prevents extending its service to other operations. Nevertheless it supplies much additional current through the Washington Water Power Company. The two systems are connected at the Montana Power station a short distance above Burke, which enables the Washington company to draw excess power from the Montana company whenever it is required.

Coeur d'Alene Wage Scale Attracts Good Miners

Labor conditions in the Cœur d'Alenes could hardly be better. The mines are operated on the "open shop" plan, this system having been adopted after years of strife under the régime of the miners' union. Throughout the year the supply of labor has been sufficient to meet the demand, but no surplus developed during the spring and summer months. The close of the year finds the usual excess, due to the suspension of outside work in other lines, causing a movement to the mines for winter employment.

The wage scale in the Cœur d'Alene district is the highest in the west, a fact that has operated in its favor by attracting desirable men. Owing to fluctuation in the price of lead, the chief product of the district, the large operating companies adopted a new sliding scale based on the price of lead, which went into effect on Nov. 16. Starting with a basic wage of $3.75 per day for miners, $3.25 for muckers and $3 for surface laborers when lead is under 5½c. per pound, the sliding provides for a bonus of 25 cents per day for each increase of half a cent in the price of lead up to 11c. Wages are adjusted on the first day of each month based on the average price of the metal during the preceding month, using the New York price as quoted by the American Smelting & Refining Co. The scale applies to all employees of the mining companies, underground and surface, mills, smelter, and office. The sliding scale was adopted voluntarily by the operators, and is a fine example of fair adjustment of wages without the intervention of grievance committees and walking delegates.

Virginia Manganese Mines to Resume Operation

The recent great demand for manganese has caused a reopening and overhauling of the manganese mines in Powell's Fort, seven miles west of Luray, Page County, Va. The mines in that region were worked extensively during the World War, but upon the signing of the armistice operations were suspended almost entirely. The mines have been reopened by the Virginia Manganese Corporation, composed of New Jersey, New York and Pennsylvania capitalists.

News From Washington

By PAUL WOOTON
Special Correspondent

Appropriation Bill for Bureau of Mint Abolishes Assay Offices at Salt Lake City, Utah, and Deadwood, S. D.

Senate and House Committees on Mines and Mining Named—Pittman Reintroduces Silver Purchase Bill

FOR the Bureau of the Mint, the Treasury Department appropriation bill reported to the House of Representatives on Dec. 18 carries funds for the collection of statistics relative to the annual production and consumption of precious metals and for the superintending of annual settlements. In addition, each of the mints receives appropriations as follows: Philadelphia mint, salaries $600,000 and contingent expenses $110,000; San Francisco mint, salaries $256,000 and contingent expenses $57,500; Carson City mint, salaries $5,280 and contingent expenses $800; Denver mint, salaries $156,710 and contingent expenses $50,000; New Orleans mint, salaries $11,160 and contingent expenses $1,500; Boise assay office, salaries $6,300, contingent expenses $1,500; Helena assay office, salaries $5,280 and contingent expenses $1,100; New York assay office, salaries $255,000 and contingent expenses $85,000; Seattle assay office, salaries $19,680 and contingent expenses $5,000.

In justifying the appropriations asked it was pointed out that the purchases of bullion at the Seattle assay office in the last fiscal year were $5,826,000, a decided increase over those of 1924, when $4,076,000 was purchased. Gold from Alaska passes through the Seattle office.

The committee acted upon the recommendation of the Director of the Mint and did not appropriate for the Salt Lake City and Deadwood assay offices. He contended that there is no justification for the continuance of those two offices in view of the amount of business done. In regard to the assay office situation the Director of the Mint said: "The assay offices at Seattle, Wash., Boise, Idaho, Helena, Mont., Carson City, Nev., and New Orleans, La., are doing enough business and are of sufficient importance to their communities to warrant the expense of keeping them open. It is my opinion that the assay offices at Salt Lake City, Utah, and Deadwood, S. D., are not of sufficient importance to their communities, or to the mining industry, to warrant the expense of their maintenance."

Senate Committee on Mines and Mining

The membership of the Senate Committee on Mines and Mining for the Sixty-ninth Congress is made up as follows: Tasker L. Oddie, of Nevada, chairman; Thomas J. Walsh, of Montana; Coleman Du Pont, of Delaware; Henry F. Ashurst, of Arizona; Key Pittman, of Nevada; Guy D. Goff, of West Virginia; William H. King, of Utah; Lynn J. Frazier, of North Dakota; Robert M. La Follette, of Wisconsin; Arthur R. Robinson, of Indiana. Ralph H. Cameron, of Arizona, has been transferred from the committee to a vacancy on the Appropriations Committee. Rice W. Means, of Colorado, also has retired from the committee to accept a place on the Committee on Public Lands.

House Committee on Mines and Mining

The membership of the Committee on Mines and Mining of the House of Representatives is as follows: John M. Robeson, of Kentucky, chairman; Arthur H. Greenwood, of Indiana; William Williamson, of South Dakota; Mell G. Underwood, of Ohio; Don B. Colton, of Utah; Joseph Whitehead, of Virginia; Charles E. Winter, of Wyoming; Andrew L. Somers, of New York; W. H. Sproul, of Kansas; Butler B. Hare, of South Carolina; George F. Brumm, of Pennsylvania; Virgil Chapman, of Kentucky; J. J. Manlove, of Missouri; Arthur M. Free, of California; Edmund M. Carpenter, of Pennsylvania, and Dan A. Sutherland, of Alaska.

Pittman Silver Bill Reintroduced

Senator Pittman, of Nevada, has reintroduced his bill directing the Secretary of the Treasury to complete purchases of silver under the Pittman act of April 23, 1918. At the last session of Congress this bill was passed by the Senate and was reported favorably by the Banking and Currency Committee of the House. The measure was caught in the legislative jam at the end of the session and was not voted upon in the House.

In view of the legislative progress which this measure made at the last session it is believed that it will go through at this session. The bill provides for the purchase by the Bureau of the Mint of 14,589,730.13 oz. of sliver at $1 per ounce. Certain allocations of silver for subsidiary coinage made in 1918, 1919 and 1920 should have been made in Pittman silver, it is contended.

Modification of Copper Mines Revaluation Asked

Copper producers are endeavoring to secure the rescinding of the order by the Commissioner of Internal Revenue as to the revaluation of copper properties. The order was based on the contention that a wrong factor had been used in the valuation of these mines. About the same time that the order was issued as to the revaluation of copper properties another order was promulgated providing for the revaluation of silver properties. In view of the fact that the silver order has been modified the copper producers feel that they should be accorded similar treatment.

Platinum Placer Claims in Grand Canyon Invalid

A decision holding that fifty-four platinum placer mining claims, in the Grand Canyon of the Colorado, located by G. Henry Stetson and his associates, were illegal, was handed down recently by Judge George M. Bourquin, of Montana, in the federal court at Phoenix, Ariz. Government affidavits on file in the case declared that Mr. Stetson and Senator Cameron were the parties at interest in the case.

The suit was brought by the government and involves claims located by defendants in 1919. The court held that as the Grand Canyon was made a national monument in 1908 and reserved as a national park in 1919, the claims were not valid. Litigation regarding other placer filings in the Grand Canyon and at Boulder Canyon by Senator Cameron and associates is now before the United States Land Office at Phoenix for decision.

Metric Standards Bill Up in Congress

One of the first bills introduced in the new Congress was the Metric Standards Bill (H.R. 10), sponsored by Fred A. Britten, Representative from Illinois. It provides for the gradual adoption of metric units of weights and measures in merchandising throughout the United States after a transition period of ten years. The Britten Bill establishes familiar terms for the main metric units, for the meter may be called the "world yard," the liter "world quart," and 500 grams "world pound." Metric advocates declare that adoption of the world standard units will benefit internal and world trade, education, agriculture, and encourage household economy.

Electric Pumps Replace Steam Equipment at C. & H.

Calumet & Hecla Consolidated, in the Michigan copper district, will pump water from a depth of a mile, vertically, using two batteries of electric vertical triplex pumps upon completion of its pump project in Tamarack No. 5 shaft. One battery of three pumps will do duty at the 52d level and three at the 24th level. Each pump will lift about 300 gal. per minute, the water being pumped from the bottom of the shaft to the 24th level and from there to surface. The pumps have been installed and work now is under way on an 8-in. water column and a 5-in. pipe conduit for the wires. The pipe lines will be hermetically sealed, and it will be spring before installation is completed, it is reported.

A power line has been extended to the shaft and a sub-station built. Adoption of electric pumping will effect a notable saving. The new system will do away with bailers in No. 5 as well as steam pumps in this shaft and in No. 5 Calumet.

Snow-Motor Crosses McKenzie Pass, Oregon

A stage-coach operator running between Eugene and Bend, Oregon, via McKenzie Pass, purchased a snow-motor and when the first big snow came he put it to work. The natives said it couldn't go up the steep, rough, deeply snow-covered pass—no motor ever did go through. The snow-motor made the grade with ease. It saved a 100-mile detour, as it is only 16 miles through the pass. Now the machine has a fourteen-passenger cab and daily runs are made. The scenic grandeur of the pass country is made accessible to tourists and a winter resort is planned.

The greatest feats of the snow-motor are to be its help to industry, which the snows of winter have always hampered. In the forests, where winter logging work and pulp-wood operations must go on in winter, the snow-motor will be a big factor in lowering transportation costs and speeding up work. Similarly, the snow-motor will prevent shutdowns, so usual in the mining industry in winter. It will furnish dependable transportation to rural public utilities, winter mail, and school children, and facilitate winter milk and freight deliveries. Those who use the snow-motor in winter can use the same Fordson tractor in summer.

Option Secured on Galena Farm Mine, Silverton, B. C.

Porcupine Goldfields Development & Finance Co. has taken a lease and option on the Galena Farm mine, at Silverton, in the Slocan district of British Columbia. The Galena Farm mine has been a steady though small producer of silver-lead and silver-zinc ores for many years, sending between two and three hundred tons to Trail each year. It is owned by the Patrick Clark estate, in Spokane, and since Clark's death has been operated chiefly by lessees, who have adopted a hand-to-mouth policy, and, consequently, no reserve has been developed. The Porcupine company has placed R. H. McLaughlin in charge of operations, and, besides developing the existing ore-shoots in the present workings, will probe for their downward extensions.

Earnings of Bingham Mines Largest Since 1917

Earnings of the Bingham Mines Co. for 1925, which will equal approximately $550,000, are the largest in the history of the company with the exception of the year 1917. The Victoria mines group of the company at Tintic earned $395,000, according to Imer Pett, general manager, compared with $230,000 in 1924 and $287,000 in 1923. In the eight years since its purchase, this mine has earned approximately $1,600,000 against a purchase price of $253,000. Earnings have also provided, in addition, $354,000 for development work.

The Eagle & Blue Bell mine, adjoining the Victoria, will earn about $75,000, the best showing since 1922.

Conditions at the Dalton and Lark have shown a steady improvement during the last two years. This year, the Dalton and Lark, at Bingham, will earn about $95,000, as compared with $85,000 in 1924 and a loss of $12,000 in 1921. Since 1908 the Bingham Mines Co. has produced about $20,000,000 of ore and earned net profits, according to Mr. Pett, after all expenses, of about $4,700,000. Acreage of the company is now 2,550 acres, of which 975 acres have been purchased or contracted for during the current year.

Earnings of the Bingham Mines Co. have been used for the retirement of all funded debts, purchase of the Victoria and other properties, and increased holdings in the Eagle & Blue Bell to the present 98 per cent interest, payment of dividends, and purchase for the treasury of 100,000 shares of stock, thereby reducing the number outstanding to 50,000, the present amount. Incidentally, the Bingham Mines Co. has shown a profit in every year since its organization in 1908.

Flin Flon Mine in Manitoba to Be Developed on Large Scale

The option taken by H. P. Whitney, of New York, and associates on the Flin Flon copper property in northern Manitoba will be exercised and development on a large scale undertaken. It is understood that the plans of the purchasers involve an expenditure of approximately $24,000,000, including the purchase price. The smelter and mill to be erected will cost about $15,000,000 and power is to be developed on the Churchill River at a cost of about $4,500,000. About 3,000 tons of material will be hauled to Flin Flon from The Pas this winter in readiness for operations in the spring. This development is expected to give a great stimulus to other mining enterprises in the area, as the Canadian Pacific Railway will build an extension of the branch now terminating at Nipawin, Sask., 131 miles west of Flin Flon. A shorter route would be provided by an extension of the Hudson Bay Railway and the construction of a branch line, and there is likely to be keen competition between the companies.

Snow-motor stage coach, near McKenzie Pass, Oregon

Hassayampa to Purchase Dredge

Exploration work on the properties of the Hassayampa Placer Gold Mining Co. has been completed, and a decision has been reached to purchase at once a modern steel dredge with a daily capacity of 10,000 yd. The company's claims are located on Hassayampa Creek near Wickenburg, Ariz. Examination work has been in progress for several months under the direction of C. M. Donohue. Test holes 60 to 80 ft. deep have been drilled at intervals of 200 yd. over a large area. The gravel is said to average 60c. a yard. Preliminary investigation has been supervised and checked by Kirby Thomas, consulting engineer, of New York. The dredge will be electrically operated.

Promising Graphite Deposits Near Burnet, Tex.

Development of the graphite mine of the Southwestern Graphite Mining Co., situated near Burnet, Tex., has progressed to the point where double shifts of miners are employed and the production is greatly increased. It is stated that this deposit of graphite is large, and modern equipment has been installed. The product is hauled to Burnet in motor trucks and here loaded on cars for shipment to Houston.

Diatomite Deposits Discovered in Ontario

A large deposit of diatomite, or infusorial earth, has been discovered in Stisted Township, in the Muskoka district of Ontario, by C. Perkin, of Toronto. The deposit, which ranges from 5 to 25 ft. in depth, extends over an area of about thirty acres, indicating 250,000 tons. The deposit will be developed by Mr. Perkin, who will erect a small calcining plant on the property, which will be opened up by a steam shovel. Underlying the diatomite is a large deposit of valuable silica silt.

Mammoth Pays 10c. Dividend

Directors of the Mammoth Mining Co., Mammoth, Utah, have declared a dividend of 10c. a share payable Dec. 23 to stock of record Dec. 16. This disbursement of $40,000, the second of the current year, will bring the company's grand total of disbursements up to approximately $2,900,000. The company is shipping from ten to twelve carloads of ore weekly.

Bonus System in Arizona Increases Miners' Pay 30 to 50 per Cent

Industrial relations between operators and miners in Arizona are generally good. On account of the relatively higher wages paid in Arizona the best Mexican miners leave the southern republic for this country. American miners are scarce. The highest wages in the state are paid at Globe-Miami, Jerome, and Bisbee where timbermen, machinemen, and muckers are paid $5.23, $4.95, and $4.40 per day respectively. A few of the smaller isolated camps pay $6 for skilled miners.

Much of the underground work is done on bonus, which increases the daily wage from one-third to one-half. Miami and Ray Copper companies pay a fixed rate per unit of work. Phelps Dodge mines at Bisbee have most of the underground work on a standardized basis. The bonus for work done over the standard set is paid in such a way that the company and the miner divide the benefit of the extra work. United Verde uses a system somewhat similar to that used at Bisbee. In all the above-mentioned cases the miner is guaranteed a basic day's pay. Common surface laborers in the camps above named receive from $2.40 to $3 per day. Mechanics receive $5.23.

A labor-saving device recently installed at the Miami Copper Mine is an Otis freight elevator of the common warehouse type. It is believed that this is the first installation of its kind for purely underground use. By means of this elevator trucks of supplies can be sent from the supply haulage level to the principal working level without unloading and reloading.

Skilled Labor Supply Inadequate in Colorado

As a result of the renewed mining activity throughout the state, a suitable labor supply has become a problem. Though the wage scale is more or less uniform in all the camps, varying from $4 to $5 a day, it does not induce a rapid return of labor from the industries which absorbed it during the recent period of mining stagnation. The principal shortage is in skilled metal miners. However, it is anticipated that this labor demand will eventually be balanced as a result of the growing competitive requirement and augmented by the open opportunity for mechanically inclined young men to serve their apprenticeship on a full-wage schedule, realizing that the machine runner, mine foreman, superintendent, manager, or operator of the near future is the mucker of today.

French Iron and Steel Industry Stimulated

Owing to the broadening of foreign purchases to take advantage of the depreciation of the franc, and also because of the pyramiding of domestic orders placed partly for stock, production of iron and steel in France has risen to new levels, according to the U. S. Department of Commerce. During October 739,000 metric tons of pig iron and 668,000 tons of steel ingots and castings were turned out, against 717,000 tons and 632,000 tons, respectively, for the preceding month. No increase in the number of furnaces in operation occurred in November.

Prices for foreign sales are rising, but the ratio of increase in quotations is less than the rate of decrease for the franc. The domestic prices on semi-finished steel and finished products is stiffening, and quotations for January deliveries are considerably higher in anticipation of higher taxes and wages and of increased material and transportation costs. Further increases are probable.

Estimating the output for November and December, the total production for 1925 approximates 8,500,000 tons of pig iron and 7,650,000 tons of steel ingots and castings, which is a considerable advance over the 1924 output of 7,657,000 tons of pig iron and 6,907,000 tons of steel ingots and castings.

Shale Plant at Rulison, Colo., Produces 40 to 60 Gal. Crude Oil Per Ton

The purpose of the Rulison station, in the De Beque territory, in Colorado, is to work out the most practical methods for oil extraction from shale. The work has been conducted by John Shaw, of Edinburgh, Scotland, who supervised the construction of the $90,000 shale experimental station. Mr. Shaw is pleased with results, and says that the Colorado shale will yield from forty-five to sixty gallons of crude oil per ton, whereas Scotch shale has been yielding only fifteen.

Bright Outlook for Colorado Mines

Robert F. McElvenny, general manager of the Colorado division of the A. S. & R. Co., in an address before the Colorado Engineering Council relative to the late improvements in metal mining, gave the following ore-production figures, which show the upward trend.

Districts	Nine Months—1925, Tons	Nine Months—1924, Tons
Clear Creek and Gilpin	4,854	2,374
Creede	6,000	3,707
Aspen	18,000	3,000

Mr. McElvenny stated that though the activity of 1880 might not be reached, the gloomy picture of two years ago has changed to one of bright prospects. The same comparative figures shown will in proportion apply to practically all the mining sections. The Colorado Lead & Zinc Co. has built a new mill at Leadville. The old smelters are being remodeled to work the ores with the Coolbaugh flotation process. All the old smelters are being eagerly sought and new ones will be built wherever there seems justification.

Canadian Graphite Corporation Installs Flotation Plant

The Canadian Graphite Corporation is installing a Simpson Engineering Co. 100-ton capacity flotation unit to be used on a graphite deposit in Quebec.

Development of Alaska's Resources Dependent Upon Transportation

By Carl F. Whitham
Chisana, Alaska

The development of Alaskan mineral resources and her growth in population are following along parallel lines with the early growth and settlement of the mineral-producing states of the West such as Montana, Idaho, and Colorado; that is, the high-grade deposits of precious minerals were profitably mined in spite of the extreme operating costs, resulting from high freight rates due to the lack of good roads and other transportation facilities.

A second and more permanent development took place in these Western states as the building of highways and railroad lines reduced the freight costs. Mineral deposits of a lower grade then could be profitably worked, resulting in the opening up and operation of numerous mines both large and small, greatly increasing the population engaged in the mining industry, and, furthermore, caused the farmers in the valleys to increase in number and become prosperous through the ready sale of their produce to the mining communities in their vicinity.

Alaska is at present just entering upon this second and more permanent stage of development. During the twenty-year period from 1891 to 1900, Alaska's mineral production was $428,456,298. The present yearly production is a little more than $20,000,000, or about half the yearly amount produced during the height of the bonanza mining period, but it is increasing in direct proportion to the extension of transportation facilities which make her mineral reserves available. This transition from the first to the second development stage is slower in taking place in Alaska than it was in the Western states, because of its remoteness and the different physical characteristics of the Alaskan Territory. It was possible in the pioneer days of the West to drive with a wagon across the plains and through the mountain valleys with little or no road building. In Alaska this is not possible. The ground is generally frozen to a considerable depth, and as the surface thaws during the summer it becomes soft and impassable for vehicles.

Development Follows Highways

Wherever highways and transport lines have been extended to the mountain mineral districts of Alaska, mining and development is taking place, oftentimes on a large scale like the present developments at the end of the Alaska Railroad at Fairbanks, or the end of the Copper River and Northwestern Railroad at Kennecott and the region adjacent thereto. Any lode deposit which contains an ore carrying mineral values of $100 per ton or over, or which can be made into a product of that value per ton, can be profitably shipped to a smelter even if located 150 miles distant from a railroad or water transportation point, provided that a highway exists upon which the ore may be sledded to the shipping point over the

winter ice and snow, using tractors for motive power.

The government-owned Alaska Railroad needs additional freight tonnage for its line, and can get that tonnage by having motor roads built to the mineral districts adjacent to its route. A motor road branching from the Richardson Highway at a point in the Copper River Valley and extending easterly to the Canadian boundary line on the White River would traverse, for over 150 miles, a region rich in gold, silver, copper, and lead deposits and also serve as an American import route for Canadian ores from the Yukon Territory to American smelters. Highways built to Alaska's many and at present remote mountain mineral reserves, linking up with some of the existing roads and cheap bases of supply, will populate her mountain districts with mining communities and her valleys with farmers.

ROAD APPROPRIATIONS $1,000,000 PER YEAR

One of the most efficient of the government organizations in Alaska is the Alaska Road Commission, which has charge of motor highway construction in Alaska and which receives for that work a yearly appropriation, from Congress and the Territory of Alaska, of about one million dollars, an appropriation entirely inadequate to the size of the territory and the importance of the work to be done. The future of Alaska's growth and greater development rests almost entirely in the hands of Congress in the appropriation of sufficient funds for highway construction. The Alaska Railroad, at present, is somewhat like an arm reaching into a treasure chest, but lacking fingers with which to grasp the treasure. Motor roads and highways will supply those fingers. At least three million dollars a year should be spent for highway construction throughout the territory, for it is only by building roads that Alaska will attain its permanent settlement and greater development in much the same manner that transportation facilities caused the settlement and development of our Western states.

If highway construction is energetically pushed, before the end of the next ten years it would become necessary to double-track the Alaska Railroad in order to handle the increasing traffic properly.

Franklin, Arcadian, and Mayflower Continue Development

Mineralization is improving in Franklin's shaft in the Kearsarge lode, Michigan. The drift south in the vein from the 400 or bottom level is in 160 ft., and is showing more copper than has previously appeared anywhere in the drift or shaft. The lode is 16 to 18 ft. wide.

Arcadian Consolidated expects soon to reach No. 8, or the Allouez conglomerate, with its crosscut from the 1,250 level of the New Arcadian shaft. The program of development after the first of the year will depend largely on developments in No. 8 conglomerate.

Mayflower-Old Colony has drifted 120 ft. in the St. Louis amygdaloid vein, no copper yet appearing.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Teck-Hughes Pays Dividends at Rate of 10 Per Cent—Argonaut Reorganization Completed

The Directors of the Teck-Hughes mine of Kirkland Lake, Ontario, have declared an initial dividend of 5 per cent, payable Feb. 1 to shareholders of record Jan. 15, being at the rate of 10 per cent a year. The company is in an excellent position, and there is no question of its being able to maintain the present dividend and increase it in the future. Developments during the last few months in particular have converted hopes into certainties and have made the mine appear much larger than before. The new levels below the 10th have only been opened up since the close of the fiscal year, in August, and some of the more interesting developments have occurred with the last six weeks.

The average of the various new exposures is approximately $23 a ton. They are of course very important in themselves, but developments also indicate that payable widths up to 50 or 60 ft. may be encountered.

The mill is treating over 6,000 tons a day, and within a month should be up to 7,000 tons. For November the production was $114,000 and in December it should run $120,000. It is believed that the company will soon consider the erection of a new mill which will give much larger tonnages. On the adjoining Kirkland Lake Gold property sinking is being continued below the 2,000 level and two new levels will be opened up. At 2,000 ft. a length of 275 ft. of ore was developed, giving an average value of approximately $30 a ton.

An official letter from the president of the Argonaut Consolidated Mines, Ltd., announces that the reorganization of the company is an accomplished fact and a financial success and that the company is assured of the necessary funds to carry development to deeper levels, where indications point to larger tonnages. It is also stated that the company is about to close a sale for its properties in Rouyn, Quebec.

Shareholders of the Night Hawk Peninsular Mines, in the Porcupine district, are being offered the unsold balance of the $500,000 first-mortgage bonds, which were issued in March of the present year. The bonds are offered at $95 with a bonus of 100 per cent in common stock. There are in the treasury approximately $166,400 of bonds, and the president states that the few shareholders, consisting mostly of Directors, who purchased the bonds before, will take an additional $60,000 to $75,000 provided the remainder of the bonds is taken up by other shareholders.

The output of the mill provides sufficient money to cover ordinary operating expenses, but will not permit of the development which the mine needs. New ore must be found to assure the future of the company, and money for this purpose is required at the rate of $13,500 a month.

During November, the Vipond treated 4,893 tons of ore and recovered $46,000, an average of $9.40 a ton. Recent developments indicate that the company has found what amounts to practically an entirely new vein system.

The Nipissing company, of Cobalt, is getting to an interesting stage in its development in South Lorrain. The company is exploring the conglomerate underneath the diabase, and has already found a mineralized system showing calcite and cobalt and low silver values. As it is so close to the Canadian Lorrain, where extremely rich ore has been developed, there are excellent possibilities that the new Nipissing silver venture may prove to be a success. The company also has interesting ground in Quebec, where it has 400 acres under option and owns 600 acres outright. Only a small amount of work has been done, and assays have been obtained showing 4 per cent to 6 per cent copper and $3 to $5.50 in gold and 2 to 3 oz. of silver over widths of 3 to 4 ft.

Good ore is continuing on the Canadian Lorrain, the raise on the 17 vein now being up 50 ft., where it shows about 4 in. of several thousand ounce ore.

In Cobalt the Kerr Lake Co. is operating two drills underground and is obtaining encouraging results. Practically no silver is being shipped, but indications point to the company again becoming a producer.

In Gowganda the Castle is continuing its shaft from 550 to 625 level. Good progress is being made with the new transmission line of the Northern Canada Power Co., and early in the spring the company will be operating with more satisfactory and better power.

Tenders are being called by the Montreal Trust Co. for bids on the assets of the Great Northern Power Co. Bids will be received up to Jan. 14. The Great Northern Power Co. went into liquidation following default of payment of the interest on its bonds. The plant is situated on the Montreal River and there is a 60-mile transmission line into Porcupine.

Shareholders Approve Canadian Asbestos Merger

At a recent meeting, the shareholders of the Asbestos Corporation of Canada approved a proposal for the merger of the company with six other asbestos-mining companies under the name of Asbestos Corporation, Ltd. W. G. Ross, president of Asbestos of Canada, stated that earnings of his company alone would be sufficient to meet bond interest and preferred dividends of the new company.

An additional 10 per cent in new common shares of the reorganized Asbestos Corporation of Canada, Ltd., was authorized to be allotted to holders of the preferred and common stocks of the old company. This means that holders of present preferred stock will receive for each share $100 in new general-mortgage 6 per cent bonds, one-fifth of a share of new 7 per cent preferred, and $1\frac{1}{10}$ shares of new common stock. Holders of the present common will receive $1\frac{1}{10}$ shares of new 7 per cent preferred, and $1\frac{1}{10}$ shares of new common stock.

London Letter

By W. A. Doman
Special Correspondent

Gold Discovered in Old Roman Mines in Hungary

Russian Manganese, and Lena Goldfields Profitable to Soviet Government

London, Dec. 8—A report comes from Hungary that government geologists have discovered in the neighborhood of Miskole, in the northern part of the country, rich deposits of gold, silver, and clay suitable for the manufacture of porcelain. The gold deposit is estimated at 15,000 kg., and the silver deposit at 75,000 kg. The deposits were first exploited by the Romans, and later by the Hungarian authorities, but in the nineteenth century work was abandoned, and the mines were forgotten. The cost of resuming operations is estimated at £100,000. Negotiations are proceeding with an American financial group concerning the lease of the mines.

An interesting rumor is in circulation concerning the manganese concession in the Ukraine. This was originally excluded from the Harriman Concession, which group, it is said, regarded the deposit as of a negligible character. The Soviet authorities, however, were of a different opinion, and apparently made a good bargain with a German group. This Ukraine concession, I now hear, was granted for two years only, so that Harrimans will have an opportunity of tendering for it in due course. The latest report is that they and the Soviet authorities have sent experts to investigate affairs.

Russia has been well to the front within the last few days so far as mining is concerned. The Ayan Corporation, which has a concession in the Okhotsk district of eastern Siberia, has held its annual meeting, at which it was stated that a well-equipped prospecting expedition arrived on the properties at the end of August and is now engaged in putting down test drill holes. As in the case of the Lena Goldfields, the directors bear tribute to the consideration shown them by the Soviet authorities.

By a somewhat circuitous route—Moscow-Copenhagen—it is learned that the Lena Goldfields, with the support of Kuhn, Loeb & Co., has taken over the "old properties," together with others. The concessionaires are under an obligation to follow a working scheme aiming at the annual production of 181,440 oz. of gold. Seven per cent of the gold and 4½ to 6 per cent of other metals are to go to the Soviet Government, and the whole property and plant gradually revert to the Soviet in from thirty to fifty years. Part of the financing is being done in London, money being raised through the medium of the Rock Investment Trust, which earlier in the year was resuscitated by M. C. Harman.

Some time ago I referred to a proposal to rearrange the capital of the Chosen Syndicate (Korea) by abolishing the distinction between the "A" and "B" shares, the former being £1 shares and the latter 1s. While the "A's" were quoted at about £2 the "B's" were £14 or £15. E. T. McCarthy is connected with the company and has reported upon the developments. Although he mentions disappointing results in some parts, the board interprets his remarks as sanguine in regard to others. The plan was accepted.

The British Government has arranged to lend £75,000 to the Southern Perak Dredging Co. (Malay) under the Trade Facilities Act. The funds will be used to install a second bucket dredge.

De Beers Diamond Mines Show Good Profit

The report of De Beers Consolidated Mines covering the year June 30, 1925, and just made public, shows a gross profit of £4,296,624, compared with £3,778,858 for the previous year, according to advices to the U. S. Department of Commerce. The directors state that during the year the diamond market remained steady, and slightly higher prices were realized by the company for its diamonds.

In their report the directors state that in January, 1925, negotiations took place between representatives of the Conference Producers and the Diamond Syndicate with the object of arranging contracts for the sale of the Producers' diamonds, but these negotiations bore no result. Subsequently, however, the three Union Producers entered into contracts for the sale of their diamonds for the period Jan. 1 to Dec. 31, 1925, to a reconstituted syndicate composed of the majority of the members of the syndicate which had purchased this company's diamonds for many years. The South African Producers made other arrangements for the disposal of their diamonds.

Since the close of the year, agreements have been concluded by the Four Conference Producers for the sale of their diamonds for a period of five years from Jan. 1, 1926, to a new syndicate which includes some of the members of the previous syndicate, with which the company had contracts for many years. The fact that all the Conference producers' diamonds are once more handled by a single organization should ensure stability to the diamond trade.

Burma Corporation, Ltd., Mines 28,204 Tons in November

Cable advices report that during November, 28,204 tons of ore were mined by the Burma Corporation, Ltd., including 1,952 tons of high-grade ore. Refinery products were 4,000 tons of refined lead, and 413,610 oz. of refined silver. The experimental zinc plant produced 2,070 tons of zinc concentrates, assaying 15.5 oz. of silver, 9.3 per cent lead, and 44.5 per cent zinc. In addition to the production noted 800 tons copper matte was produced from the treatment of accumulated smelter byproducts, and 4,077 tons copper ore. Included in the tonnage of refined lead is 491 tons recovered from the smelting of copper ore.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal October Gold Production 812,832 Oz.—Interest in Platinum Continues

Johannesburg, Nov. 17—The output of Transvaal gold for the month of October was declared by the Chamber of Mines on Nov. 10 as 812,832 oz., having a value of £3,452,691. These figures show an increase over September of 15,585 oz. and £66,201, in value. October had twenty-seven working days, and the daily average works out at only 30,105 oz., which is the lowest for this year. This low figure is due to the shortage of native labor. On the Rand gold mines, on Oct. 31, 169,206 natives were at work, as compared with 177,954 natives at work at the end of October, 1924.

A report by Dr. Hans Merensky on the platinum occurrence near Potgietersrust was issued last week, to shareholders of the Potgietersrust Platinums, Ltd. This company controls an enormous mineral area, within the platiniferous norite formation, covering 135,000 English acres and attaining a length, on the line of strike, of approximately 30 miles. The best-known oreshoots are situated on the Zandsloot farm, where values over 30 to 50 ft. in width average 3 to 4 dwt. per ton. Recent development, on the boundary of Vaalkop and Zwartfontein improved on this and showed values of 7 dwt. over 34 ft. average thickness. The shaft on Vaalkop at 10 ft. in depth showed very excellent values—namely, an average of 11.8 dwt. These shafts will be sunk to the 100-ft. level and plant equipment is on order to expedite the rapid development of this section. The trench work north and south is, simultaneously, being continued energetically.

The second annual meeting of Transvaal Platinum, Ltd., was held on Nov. 12, at the Corner House, Johannesburg, W. H. A. Lawrence presiding. A Sulzer centrifugal pump has been installed on the 150-ft. level, Welgevonden, which is handling all the water in that portion of the mine. The reserves of ore on June 30 totaled 7,359 tons, of an average value of 10.3 dwt. platinoids per ton. The pilot plant, at present in course of erection, is a gravity concentration arrangement, consisting of a crusher, a ball-granulator, a Dorr classifier, and Senn Pan tables, designed to treat 750 to 1.000 tons of ore per month. To begin with, the tailings from this plant will be stored for retreatment, by whatever method further experiments may indicate to be the most effective and economical. It is proposed to add a small chlorine plant to treat the concentrates from Welgevonden ore and for further experimental work on flotation concentrates from both farms. A small experimental flotation unit from Minerals Separation, Ltd., will also be tried. This recovery work is of a pioneer nature, as no such platiniferous occurrence has been known before, under exactly identical conditions.

Men You Should Know About

Elmer E. Paxton, director and general manager of the Engels Copper Mining Co., resigned recently, but will continue as a director of the company.

F. Park Geyer, president, and **W. A. Moncrief,** vice-president of the Marland Oil Co., of Texas, have returned to Fort Worth, Tex., from a business trip to the East.

W. A. Hooten, mining engineer, is in Alberta, Canada, in charge of placer drilling operations for Chicago clients of the Southwestern Engineering Corporation.

Walter A. Schmidt, president and general manager of the Western Precipitation Co., of Los Angeles, recently returned to New York from a business trip to Europe.

B. Britton Gottsberger, of the faculty of Yale, who had been in Europe for three weeks; **George H. Carnahan,** and **Frank H. Carney** recently returned to the United States from abroad.

Clarence C. Malmstrom, who has been assistant melter and refiner at the Denver mint, has been advanced to the office of assayer. He has been connected with the mint for twenty-one years.

A. R. Archibald, president and general manager of the Nevada Consolidated Mines Co. at Grass Valley, Calif., was recently in San Francisco in connection with the purchase of cyanide equipment for his property.

Percy B. Reid, formerly chief controller of Chinese Immigration and Division Commissioner of Immigration on the Pacific Coast, has been appointed Gold Commissioner of the Yukon Territory, with headquarters at Dawson.

Major H. Waters Van Ness, R. E., of London, who has been making examinations in the Mixteca section of Oaxaca, Mexico, has returned to Mexico City and northern points, having announced that he will return and be temporarily located in Oaxaca.

Hans Lundberg, field manager of the Swedish American Prospecting Corporation, and **Karl Sundberg,** an engineer affiliated with the same organization, have been awarded gold medals for meritorious work in electrical engineering, by the Engineering Academy of Sweden.

T. C. Wilson, mining engineer, for eleven years foreman of the Timber Butte mill of the W. A. Clark interests, recently left Butte to become general manager of a new mill at Leadville, Colo. Before his departure he was presented with a handsome gold watch by the mill employees.

H. S. Lyne, petroleum geologist of Australia, has been engaged to join the geological staff of the Standard Oil Co. Prior to his departure for his new post the directors of the South Australian Oil Wells Co., for which Mr. Lyne has acted as consulting geologist, gave him a farewell luncheon.

James W. Gemmell has been appointed vice-president of the Lake Superior Corporation and Algoma Steel Corporation, of Sault Ste. Marie, Ont., in charge of finance and accounts of both corporations and subsidiary companies. He remains treasurer of the Lake Superior Corporation.

O. H. Griggs, of Los Angeles, and **Frank A. Kennedy,** of Boise, Idaho, both former operators on the Mesabi iron range, have made a joint examination of the Mother Lode Copper Co.'s properties near Baker, Ore., and of the Red Ledge property owned by the Idaho Copper Company, Ltd., in Adams County, Idaho.

Guy C. Riddell

Guy C. Riddell has returned to New York after a three months' trip to England, and is again at his office at No. 1 Broadway, New York City.

Dr. George Rogers Mansfield, of the U. S. Geological Survey, recently visited the Idaho School of Mines at Moscow, and gave a series of addresses on the areal and structural geology of southeastern Idaho, where for many years he has been engaged in an intensive and detailed study of the great Permian phosphate deposits.

R. E. Clarke recently resigned as general purchasing agent of the Utah Copper Co., the Nevada Consolidated Copper Co., the Nevada Northern R.R. Co., the Ray Consolidated Copper Co., the Butte & Superior Mining Co., and the other of the D. C. Jackling's Associated Companies and has become associated with the American Rubber Manufacturing Co. in the capacity of vice-president in charge of sales.

Fred M. Prescott, of Menominee, Mich., and **Abe Mathews,** of Wakefield, Mich., have been appointed by Governor Groesbeck of Michigan to the board of control of the Michigan College of Mines at Houghton. They succeed **John R. Van Evera,** of Marquette, and **Ocha Potter,** of Ahmeek, whose terms of membership have expired. Mr. Prescott is president of the Prescott company, a manufacturer of pumps. Mr. Mathews is an executive for Pickands, Mather & Co.

Obituary

W. J. Kirby, a Spokane mining engineer, was killed recently by a fall in the East Pacific property near Winston, Mont. He was fifty-two years old.

Charles E. Finney, long identified with mining and smelting interests in the United States and with various railroads and industrial and financial institutions, died in Chatham, N. J., on Dec. 11. In 1888 he entered the service of the Consolidated Kansas City Smelting & Refining Co., and later was with the Messrs. Guggenheim as manager of mines, smelters, and refineries in the United States and Mexico, and with the American Smelting & Refining Co. Mr. Finney, when the Guggenheim Exploration Co. was organized, in 1900, had charge of the initial operations of that company, and was subsequently engaged in many metallurgical and mining enterprises. His entire business life had been devoted to the mining and metallurgical industries, in which he was widely known.

Charles E. Knox, highly esteemed as a mining man and well known in the West, especially in Nevada, died on Nov. 4, 1925, at his home in Berkeley, Calif., He was fifty-eight years of age. Independence, Mo., was his birthplace. His first mining experience was as early as 1890, in Montana, where he was manager of the Monitor Gold Mining Co., which was owned by his father, the son being also a stockholder in the enterprise, which paid dividends for several years. He did not remain long in Montana, and returned to Independence, where he organized a manufacturing company which specialized in hose-reel and fire equipment. This business grew rapidly, and it became necessary to transfer it to Philadelphia, which became his home for the time being. The call of the West proved strong, however, and he sold a part of his interest in the company and went to Nevada at a time when Tonopah first began to attract attention. He organized the Montana-Tonopah Co. and undertook deep exploration in an area north of the Mizpah mine. Success was attained, and the first cyanide mill was constructed on the slopes of Mount Oddie. This mill became the prototype of later mills. The Montana under his efficient management made an excellent record. Knox took an active interest in the welfare of his employees and also in Tonopah and Nevada generally. Not so long ago he organized another development company and began operations on the Gypsy Queen shaft. The shaft was equipped and considerable progress had been made in sinking at the time of Knox's death. He was vice-president and general manager of the Mispah Extension Co., of Tonopah, and had interests in many of the prospects and mines of Goldfield. He effected an organization of the Lucky Boy at Hawthorne, Nev., and was president of the Black Oak mines, at Soulsbyville, Calif. Well informed in mining matters, Charles Knox through his interest in others, won the friendship and the regard of many in the West, who will regret sincerely his passing.

Societies, Addresses, and Reports

South America Offers Mining Opportunities

Possibilities and Conditions in Argentina, Brazil and Other Countries Considered by Engineers at Meeting of New York Section of A.I.M.E.

THE NEW YORK SECTION of the American Institute of Mining and Metallurgical Engineers held its regular meeting on Dec. 15, at the Harvard Club, New York City. Charles M. Weld presided and introduced President J. V. W. Reynders, who spoke upon the relation of the Institute's local sections to the parent body. Mr. Reynders concluded with the statement that much of the effectiveness of the organization was wrapped up in the activities of the local sections.

H. Foster Bain, secretary of the A.I.M.E. and the speaker of the evening, presented his subject, "The Mining Possibilities of Argentina," effectively and in a way that greatly interested the audience. He visualized the geographical extent of Argentina by comparing it to equivalent areas in the western half of the northern continent. He then gave it a population of 9,000,000 and plunged into the mining part of his subject.

Mr. Bain first discussed the Misiones territory, the extreme northeastern tip of Argentina, which he characterized as most like the Ozark region of the United States. Certain lateritic iron ores had been discovered here, but subsequent investigation proved them to be of little commercial value. He mentioned the limestones of Cordoba, with which are associated an unimportant series of small veins bearing gold, silver, copper, lead, and other ores. These limestones are of importance, however. Cement manufacturing based upon similar limestone found north of Buenos Aires has been established as a local industry. The intervening mountain ranges east of the Andes were considered in order. The San Luis Range is a complex of ancient crystalline rocks and andesites of later origin. Tungsten, mica, quartz, and some tin ore as well as copper ore, the last-named probably associated with the andesites, are found in this range. The Famatina range, extending to over 18,000 ft. in altitude, contains ore deposits similar to the Cerro de Pasco type, but the silver values are much lower and the oreshoots are short and narrow. The Capellitas mine, at which a number of American mining engineers had acquired their early experiences, was briefly described. Secretary Bain stated that Catamarca Province contained ore deposits of a type similar to those in Butte. The region is at an altitude of 3,000 meters above sea level and is difficult of access and without wood. In northwest Argentina many veins occur similar to those in Bolivia. Evidently lead ores are widely distributed. In the plateau region are borax deposits. The Province of Mendoza was likened to Colorado.

Respecting the Argentinians, Secretary Bain stated that the population is agricultural and has but little interest in mining, although the country is rich in available capital. A friendly feeling is, however, shown to the foreigners who have mining ventures in the country.

Concluding, Mr. Bain said that there is some opportunity in mining. He instanced the success of the National Lead Co. and an Argentina company, both of which supply the lead needed in the domestic market. Lead mining therefore offers some promise. With respect to copper mining, the Secretary was less hopeful. In structural materials there was little doubt that Argentina could supply its own requirements. The petroleum resources are important, and the results so far obtained in the producing oil fields are such that the American companies interested in their exploitation find it worth while to continue with their development.

Mr. Weld, the chairman, then briefly directed attention to the iron-ore deposits in Brazil and the possibilities of manufacturing iron and steel in that country. He called upon W. H. Staver to tell something about his experiences there. Mr. Staver stated that he was now interested in rock crystal, which is established upon a commercial basis, with an increasing market, prices ranging from $2 up to $10 per pound, depending upon size and quality. Japan and Germany are the principal markets and both absorb more than all other countries combined. Rock crystal is found in certain localities in Brazil, but the small deposits are scattered. The crystals are water clear and range in size from 4 to 10 lb. It is difficult to sell them to advantage, but the business offers many possibilities. Mr. Staver stated that the Chinese use rock crystal lenses in eyeglasses. Nine-tenths of the lens manufacturing business is done by the Germans. Beads for jewelry and crystal balls are also made from rock crystal.

Turning his attention to gold mining, which he characterized as a decadent industry in Brazil, first established there by the Portuguese over 200 years ago, Mr. Staver said that many of the gold-mining regions were in the same condition as their counterparts in the Virginias and Carolinas. He described how he had prospected in the region of the Morro Velho mine and had exposed a network of gold-bearing veins in the same belt as the Morro Velho.

Today, said Mr. Staver, Brazil is producing manganese ore at a loss. Fluctuating exchange makes all Brazilian business very uncertain. It is therefore necessary to do business upon a very large profit margin. Mining offers many chances in rare earths, manganese ore, and precious stones because the profit margin upon these is usually large. He had seen, he said, only one diamond-washing plant in Brazil. In this instance a bit of virgin ground had been left beneath a dam by the pioneer miners. The ground was worked by passing it through trommels and jigs, the final cleanup being made with the batea. A new diamond field is being opened up in Matto Grosso, but conditions are not at present favorable for systematic working. Mr. Staver concluded his discussion by describing his finding of rock crystals in manganese ore and his chromite mining experiences in 1917. He called attention to the large number of chromite deposits in Bahia.

The chairman skillfully introduced E. P. Mathewson before the applause attending Mr. Stavers' effort had subsided, and "E. P." began his subject, "Mining in South America," by starting at Panama and with Brobdinagian strides proceeding down the west coast of that continent. He did not say much about each district, nor did he miss much. Dramatically he told how he had years ago the opportunity of selling Chuquicamata, lock, stock and barrel, to some representative of the Guggenheims for a paltry £45,000, but had failed to awaken any interest. Years later, he had received a picture showing this same individual standing before the Chile Copper Co.'s plant.

With a mention of the experiences of a mining company in Tierra del Fuego, Mr. Mathewson stepped around to the Atlantic Coast, skipped over Argentina and Brazil, and briefly mentioned the bauxite deposits of British Guiana and Dutch Guiana before he concluded his interesting sketch about mining in South America. The meeting was well attended, enthusiastic and worth-while.

Boulder Mining Association Opposes Park Extension in Colorado

Mining men of Colorado in general and of Boulder County, that state, in particular are vigorously protesting the proposed revision of the boundary lines of Rocky Mountain National Park to include 60,000 acres of ground extending south of the present limits along the crest of the Continental Divide.

At a meeting of the Boulder County Metal Mining Association and the Boulder Grubstake Association on Nov. 30, resolutions were adopted opposing the revision. Similar legislation will be introduced before the Colorado Mining Association.

The proposed addition contains deposits of lead, zinc, cobalt, silver, and gold, according to mining men who are familiar with the region. Some of them, notably around Albion, in western Boulder County, have been successfully worked in the past, and it is possible that the coming summer will see renewed activity. Most of the deposits lie close to the range summit and are not commercially important now because of inadequate transportation. They do offer potential future resources, however.

The resolutions adopted locally attack the proposed park extension as inimical to the mining interests and opposed to the public policy of the West.

Recent Technical Publications

Reviews, Abstracts, and References

The Economics of Coal

The Case of Bituminous Coal. By Walton H. Hamilton and Helen R. Wright. The Macmillan Co., New York. Price $2.50.

Like a nightmare is this volume from the pens of Walton H. Hamilton and Helen R. Wright, of the Institute of Economics, in Washington. The chapters are well headed by verses from Gilbert & Sullivan. These patter quotations suggest that after all the grim facts of excessive development, overmanning, a decline in the rate of increase of consumption and faulty accounting there is still some hope left if we will but keep our good humor and our poise. The authors have their facts straight, but have been too greatly impressed by them.

Our economists in general have made their inquiries into too few industries and may we add therefore that in consequence the best of them are relatively inexperienced. When they have plunged into the statistics of a few other industries as zealously as they have into those of the coal industry, they will be less disposed to feel alarm. Confidence in economists has been shaken. They erred when they estimated how long nations could remain in war without bankruptcy. They erred again when they attempted to forecast the world-wide and national outcomes of gross inflation. Perhaps they err also in believing that coal faces a future of never-ending expansion and ever-increasing misfortune. The reviewer thanks them for that grateful sense of humor that prevented them from heading each chapter with a lugubrious verse from Dante. The book is rarely unfair to the coal operator, who appears indeed merely as a puppet in the hands of an unkindly fate.

R. DAWSON HALL.

Silicosis—Technical Paper 372 of the U. S. Bureau of Mines, by R. R. Sayers, (24 pages, price 15c. from the Superintendent of Documents, Washington, D. C.) is entitled "Silicosis Among Miners." Among the subjects discussed are the prevalence of silicosis, conditions promoting it, the effects of rock dust on the lungs, stages of silicosis, determination of dust in the air, and methods of protection against dust.

Chinese Zinc — *The Far Eastern Review* for August (16 Jinkee Road, Shanghai, China; price 50c.) has a six-page article on the new zinc works of Quang-Yen, entitled "Zinc Metallurgy in Tonkin." It is by M. Raby. The plant is designed for a capacity of 6,000 tons of zinc annually, but so far only one of the six proposed Van Gulck regenerative retort furnaces has been erected.

Electric Furnace Linings — G. F. Hughes, of the Bridgeport Brass Co., has an article on this subject in the December issue of *The Metal Industry* (New York; 10c.). The paper was read before the meeting of the American Foundrymen's Association last fall.

Mining Practice—"The Support of Underground Workings" is discussed in a continued article, the first installment of which appeared in *The South African Mining and Engineering Journal* for Oct. 31, 1925 (Johannesburg, Transvaal; price 6d.). The methods in use on the Witwatersrand are described, with the aid of some good photographs. Most of the workings are supported by the "pig-sty pack," which consists of a rectangular inclosure formed by rough, round timbers and packed up solidly with waste rock. Each timber is notched in two places to take the ends of the two timbers that rest upon it. These notches restrain the pack from bursting when it takes the weight of the hanging. The inclosure is erected first, and wedged up solidly to the hanging, after which waste rock is fed into it and packed as tightly as possible.

Magnesium — "Magnesium and Its Compounds in 1924," by J. M. Hill and G. F. Loughlin, 16 pages, has been issued as a separate chapter of "Mineral Resources," by the U. S. Bureau of Mines. Copies are obtainable for 5c. each from the Superintendent of Documents, Washington, D. C.

Geology—The *Bulletin* of the Institution of Mining and Metallurgy for November (London, E. C. 1) has two papers of interest to geologists, either of which may be obtained for 1s. One is by Robert A. Mackay, 14 pages, on "The Influence of Superimposed Strata on the Deposition of Certain Lead-Zinc Ores," and the other 12 pages, by H. C. Boydell, "Economic Geology and the Mining Industry."

Patents

Casting Copper—No. 1,564,369. Dec. 8, 1925. Leonard Shipley, Dundalk, Md., assignor to American Smelting & Refining Co., New York. A method of casting copper consisting of pouring the molten metal into open molds and immediately covering them closely enough to prevent free contact with the air but permitting the escape of gases, so that surface oxidation, rapid cooling, and sudden degasification are prevented.

Magnetic Separation — Nos. 1,564,-731-2. Dec. 8, 1925. Joseph Weatherby, New Cumberland, Pa., assignor to Weatherby Ore Separator Co., Philadelphia. A method of electrically separating minerals from gangue by passing the ore pulp between a progressive multiphase magnetic field and an induced field.

Rock Drill—Nos. 1,563,632-3. Dec. 1, 1925. C. A. Hultquist, Los Angeles. Design for a pneumatic piston drill.

No. 1,564,780. Dec. 8, 1925. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design for a dustless hammer drill.

No. 1,564,975. Dec. 8, 1925. William Prellwitz, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design for a steel retainer for rock drills.

Hydrometallurgy—No. 1,565,072. Dec. 8, 1925. F. E. Elmore, Boxmoor, England, assignor to Niels C. Christensen, Salt Lake City, Utah. Argentiferous lead-zinc sulphide ore is mixed with salt and heated, in the presence of air, above 400 deg. C., but not high enough to cause volatilization of the lead chloride. The zinc sulphide remains for the most part unattacked. The oxidized mixture is then extracted with a strong solution of salt, and the silver dissolved out of the residue. Patent No. 1,565,-073 covers a similar method of treatment, but without using salt in the roast, and employing acid brine solutions for leaching.

No. 1,565,353. Dec. 15, 1925. A. T. K. Estelle, Hagen, Germany. Iron sulphide ores containing other metals are heated in a non-oxidizing atmosphere, cooled, ground, and concentrated. Leaching is then carried out with dilute sulphuric acid, and the copper removed from the solution. The sulphate of iron is crystallized and then treated with ammonia vapor and air. The product is dried, and the ammonium sulphate washed out and crystallized. A flow sheet accompanies the patent.

No. 1,565,216. Dec. 8, 1925. S. C. Smith, London, England. Liquors containing zinc, chlorine, and sulphate ions are treated with barium chloride for precipitating the sulphate ions; then heated with barium carbonate to precipitate zinc carbonate and obtain a solution containing barium chloride for the use first mentioned.

Refractory — No. 1,565,084. Dec. 8, 1925. H. G. Frerichs, Bartonville, Ill. A monolithic magnesite taphole refractory, of tubular cross-section, for furnaces.

No. 1,565,472. Dec. 15, 1925. F. C. F. le Coultre, Marseilles, France, assignor to Société d'Etude des Agglomérés, Paris, France. A refractory cement made of pure oxide of zirconium, an organic binder, an inorganic binder, and finely crushed powder of zirconium ore.

Metallurgy of Zinc — No. 1,565,928. Dec. 15, 1925. H. A. Grine, Clarksburg, W. Va., assignor to The Grasselli Chemical Co., Cleveland, O. A composition for zinc condensers comprising broken zinc condenser, zinc ore, and a refractory bonding material.

No. 1,566,183. Dec. 15, 1925. C. E. Cornelius, Stockholm, Sweden, assignor to Trollhättans Elektrothermiska Aktiebolag, Stockholm. A method of vaporizing metals by a reduction process, cooling the vapors to a powder, and subjecting the powder to a heating and mechanical action to convert it to a liquid state.

No. 1,566,103. Dec. 15, 1925. M. P. Kirk, Harbor City, Calif., assignor to Kirk Simon Smelting Co., Mina, Nev. An apparatus for producing zinc oxide from zinc compounds, using a rotary kiln from which the zinc fumes are led into a zinc combustion chamber.

Lead Refining—No. 1,566,078. Dec. 15, 1925. P. W. Davis, Cambridge, Mass. Lead alloys in molten condition are exposed to the action of molten litharge by causing the two materials to be exposed to each other in bodies of small dimensions.

New Machinery and Inventions

New Truck Crane Light, Compact and Strongly Built

A new truck and trailer crane is now being placed on the market. This machine is said to embody the valuable combination of speed, compactness, light weight, sturdiness, and complete accessibility. The great value of these features are better realized when considered along with the advantages which they give in the operation of this crane.

The truck or trailer mounting enables the crane to move at regular truck speed, thus cutting down the inactive time to a minimum. It is equally fast in operation, having a line speed of 125 ft. per minute and a swing speed of 5 r.p.m.

All three drums are mounted on one shaft. The hoisting and digging drums are mounted side by side, and the boom hoist is placed on the end of this shaft, at the left side of the machine. This arrangement of machinery makes it possible to have every piece of main machinery behind the center pin, thus giving better balance and eliminating the necessity of a large amount of counterweight (only 1,000 lb. being used). This type of construction gives the very short tail swing of 7 ft. 1½ in. and an over-all width of 8 ft. 4 in. Thus the machine is able to work in close quarters or to travel in narrow alleys.

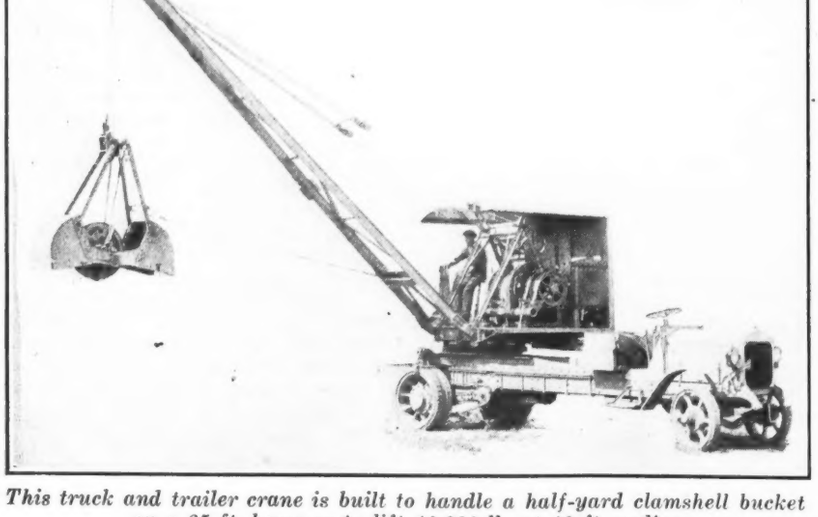
The total weight is 13,000 lb., which makes it possible for a 5- or 7½-ton truck to handle the crane and also reduces the danger of miring in soft ground.

Sturdiness is obtained by cast-steel revolving frame, cast-steel drum bearing frames, and heavy swing gear with I-beam spokes and outside teeth. Thus there are no rivets to work loose and the frames are always rigid.

The crane is built to handle a ½-cu.yd. clamshell bucket on a 25-ft. boom, or for lifting 10,000 lb. at 10-ft. radius. It is driven by a four-cylinder, 40-hp. motor, which operates at a governed speed of 1,000 r.p.m. The motor is placed at the rear of the revolving frame and is entirely accessible for care and operation.

This truck and trailer crane may be equipped with clamshell or dragline bucket, crane hook, electric magnet, or pile driver, and thus may be used for a wide variety of purposes. Handling coal, sand, gravel, pipe, poles, lumber, stones, snow, iron, coke, or steel is only a part of the many duties which may be performed by this machine.

The Harnischfeger Corporation of Milwaukee, Wis., who makes this crane, has issued a complete bulletin covering it, copies of which may be obtained by request to any of its offices.

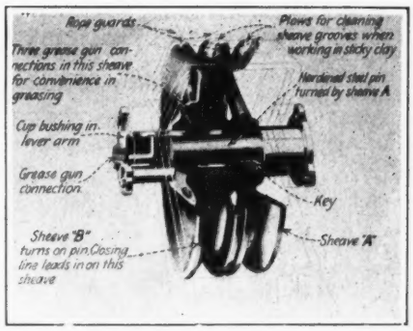


This truck and trailer crane is built to handle a half-yard clamshell bucket on a 25-ft. boom or to lift 10,000 lb. at 10-ft. radius

Makes Clamshell Bearings Wear Longer

Since the second sheave in a block-and-tackle reeving moves at about one-half the speed of the first sheave, the Blaw-Knox Co., Pittsburgh, Pa., has taken advantage of this fact to reduce the bearing speeds on its Dreadnaught clamshell bucket by about one-half. The new design furthermore doubles the bearing areas.

Referring to the illustration, sheave *A* turns at about one-half the speed of sheave *B*. Instead of turning the sheave on a short fixed pin, as is the usual practice, the pin itself is revolved at one-half the speed of the closing line by keying it to sheave *A*. Sheave *B*, with its extra long bearing, obtained by offsetting the hub of sheave *A*, turns of course, at full line speed but it turns on a surface moving at one-half speed in the same direction. The bearing speed is, therefore, one-half, arrived at by the difference between the full speed of sheave *B* and the half speed of the pin. This new arrangement is claimed by the company to increase the life of bearings


Rope guards
Plows for cleaning sheave grooves when working in sticky clay
Three grease gun connections in this sheave for convenience in greasing
Hardened steel pin turned by sheave A
Cup bushing in lever arm
Grease gun connection
Key
Sheave "B" turns on pin. Closing line leads in on this sheave
Sheave "A"

Features of design intended to reduce wear on clamshell bearings are shown in this view

and sheaves in clamshell buckets from 10 to 20 times over the old method of using a fixed pin.

The vulnerable point in a lever arm bucket has always been these sheaves and bearings at the end of the lever arm. They must be fully protected against the entry of sand and other materials which destroy the bearings and bushings. The outside ends of the bearings have no openings and oozing of the grease at the inside as the pin moves slightly, similar to a piston in a cylinder, seals the bearings effectively. The large cup bushings effectively prevent wobbling of the sheaves with resultant flange wear. Wherever motion occurs a bushing is provided and a high pressure Alemite gun is used to force grease into the bearing.

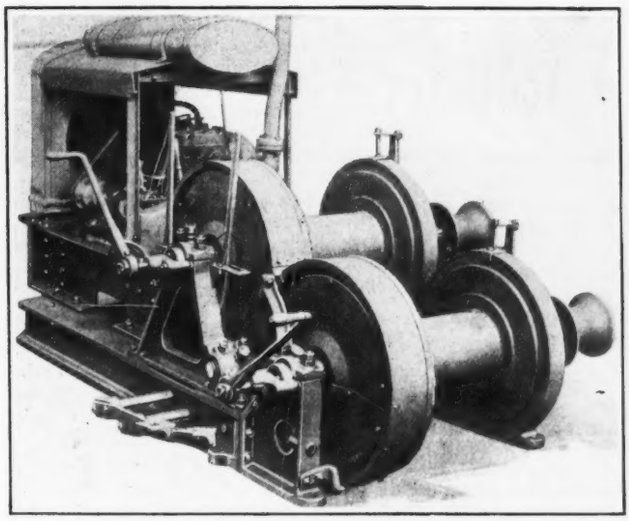
Wider Use of Automatic Control During 1925, Says Review

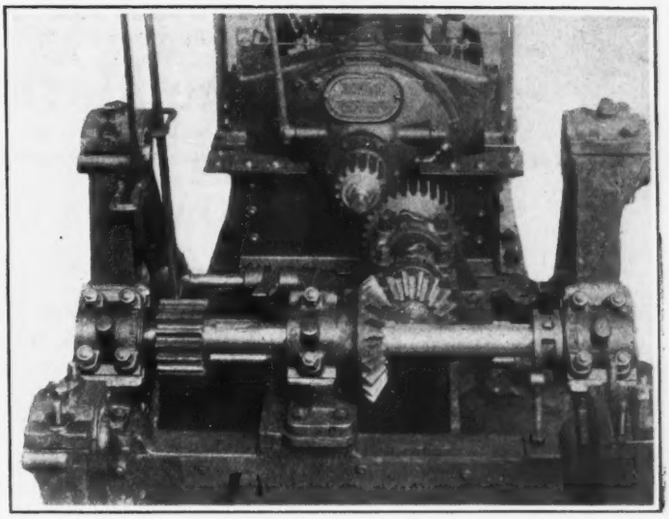
The automatic-control principle was utilized for larger machines in power plants and substations, and its use was further extended in railway, mining, and industrial power systems, according to John Liston in his review of the year's activities of the General Electric Co. Special control apparatus was designed for new applications of motor drive, and numerous ingenious relays were produced for actuating and protecting industrial control and automatic station equipment.

Steam turbines of exceptional capacity were constructed during 1925, and high steam pressures and superheating were more generally adopted. Certain classes of transformers were also carried to new high-unit ratings, with corresponding increases in their switching equipment.

In transportation, there was a further adoption of the economical oil-electric locomotive, a record-breaking cross-continental run by an oil-electric car, and an increased use of gas-electric buses for the purpose of feeder service to railways.

Research work revealed factors of fundamental importance in cable characteristics and made feasible the construction of cable conductors insulated for higher potentials. Testing transformer sets were constructed for the highest commercial-frequency voltages so far secured, and were utilized in a variety of investigations, of which those on lightning arresters were especially valuable.





Left, new gear-driven gasoline hoist. Right, gear-drive arrangement with gear guards and drums removed

Gasoline Hoist Now Furnished With Gear Drive

The gasoline hoist made by the American Hoist & Derrick Co., of St. Paul, Minn., has recently been redesigned, this changing it from chain drive to gear drive. The new hoists are driven by means of spur-and-bevel gears with an intermediate longitudinal shaft placed at right angles to the pinion shaft, which is the crankshaft on a steam hoist, the gasoline motor being mounted lengthwise instead of crosswise on the hoist.

The pinion shaft has a bevel gear near its center which engages with a bevel pinion on the end of the intermediate longitudinal shaft. On the other end of this shaft there is a spur gear which engages with the pinion on the engine crankshaft. The intermediate shaft is mounted at nearly the center lengthwise of the bed and is supported by heavy babbitted boxes. One of the accompanying illustrations clearly shows the gear drive arrangement with the gear guard and drums removed.

The principal advantage of the new gear drive over the old chain drive is that power is transmitted directly to the pinion shaft of the hoist which is between the two rear drums and from there to the friction gears by at least two teeth—one to each adjoining friction gear—whereas on the old arrangement power was transmitted to the rear drum and from there to the rest of the drums by only one gear tooth.

The entire hoist is mounted on a cast-iron bedplate. The gasoline engine is mounted on the bedplate in place of the boiler or electric motor. The hoist has the drum equipment of the regular "American" steam hoisting engine.

Unique Arrangement for Hauling Loaded Larry Cars

At the Birmingham, Ala., plant of the Southern Clay Manufacturing Co. it was necessary to provide some form of transportation by alternating current for transferring loaded larry cars from the drying ovens to the kilns. The problem was solved by designing a transfer car to carry one larry car weighing approximately 2,900 lb. loaded.

Power is supplied from three overhead trolleys connected to the 220-volt, 3-phase source. The driving motor is a General Electric, 5-hp., 900-r.p.m. 3-phase, 60-cycle, 220-volt machine, and a duplicate motor is mounted on the car driving a winch used to pull the larry cars on and off the transfer platform.

Control is provided by a drum controller and a resistor, both General Electric. An arrangement of two tripple-pole, double-thrown, fused knife switches provides for transferring the control from one motor to the other. These switches are mounted on the back of the bench. The control regulates the driving motor while moving the car. It is then switched over to the winch motor, which pulls a loaded larry on the transfer platform, and then it is switched back to the driving motor. A satisfactory control for the transfer car is thus provided.

Trade Catalogs

Mine Fans—Bulletin 3313, issued by The American Blower Co., Detroit, Mich., covers the company's Type D mine fans.

Electric Furnaces—Vom Baur Engineering Corporation, Woolworth Building, New York, has issued Bulletin 1125 covering electric furnaces for melting and refining steel, gray iron, malleable iron, and ferromanganese.

Power Shovel—The Bucyrus 120-B 4-yd. revolving shovel, steam and electric, for quarry mining and heavy rock excavation, is covered in a 4-page bulletin issued by the Bucyrus Co., South Milwaukee, Wis.

Jaw Crusher—Bulletin 1099 of the Traylor Engineering & Manufacturing Co., Allentown, Pa., covers the Bulldog jaw crusher, superseding Bulletin 99.

Grinding Mill—In Bulletin 1108, just issued by the Traylor Engineering & Manufacturing Co., Allentown, Pa., the company's line of compartment mills is featured.

Achievements in Excavating Machinery Told

Any manufacturer of excavating machinery must be continually improving his product in both workmanship and design. It is, therefore, often a difficult task to single out the most outstanding achievements for a given time. The four following have been chosen by the Bucyrus Company as among the most important of its accomplishments for the year 1925.

A 4-yd. full revolving shovel for quarry and mine service was announced. This machine, designed for rock digging and called the 120-B, is claimed to be much more rugged than even the railroad-type shovel. It combines the speed of action of the railroad-type shovel and its tremendous power, with the full circle swing, long reach, and other advantages of the Whirley. The machine weighs approximately 140 tons and is built for either steam or electric power.

Second, fourteen years ago, caterpillars were first applied to shovels and draglines. This year the company has applied a mounting of this type to one of its big Class 320 draglines, a machine weighing nearly 400 tons and equipped with a dipper of 8 cu.yd. capacity.

Third, electric shovels driven by three shunt motors with Ward-Leonard control have been introduced. The shunt motor with this control has been used for some time on both the swing and hoist of electric shovels, but its application to the thrust is believed to be entirely new.

Fourth, a dipper dredge even larger than the dredges of that type used in constructing the Panama Canal is at present under construction. This huge dredge, although the dipper capacity is only 10 cu.yd. (those at Panama were 15 cu.yd.), is probably the largest and most rugged machine of its kind ever built. It is driven through electric motors by Diesel engines. The horsepower is 1,200. As far as is known, it is the only large dipper dredge to be driven by Diesel engines up to the present time.

The Market Report

Metal Markets Quieting Down for the Holidays

Fair Volume of Sales Until Yesterday, at Prices Practically Unchanged from Last Week

New York, Dec. 23, 1925. — Since 1919, the week before Christmas and the week between Christmas and New Year's have been exceedingly quiet ones in the metal markets, and this year promises to be no exception. Sales kept up remarkably well until yesterday, however, the lead business being especially good. The improved tone of the foreign markets was no doubt an important factor, London prices on all metals being higher today than a week ago. Domestic metal prices have changed but slightly, if at all, from last week. There is expectation that foreign buying will show considerable improvement in January over December, and if this proves true, and domestic business keeps up to the high level of the closing months of 1925, metal prices should respond.

Daily Prices of Metals

Dec.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N.Y.	St. L.	St. L
17	13.90	61.375	62.375	9.25	9.10	8.35@8.65
18	13.975	61.25	62.25	9.25	9.10	8.375@8.75
19	14 025	61.125	62.125	9.25	9.10	8.35@8.675
21	14.05	61.875	62.75	9.25	9.10	8.55@8.65
22	14.025	61.875	62.625	9.25	9.10	8.50@8.60
23	13.875@14.00	62.125	62.875	9.25	9.10	8.50@8.65
Av.	13.985	61.604	62.500	9.25	9.10	8.550

*The prices correspond to the following quotations for copper delivered: Dec. 17th, 14.15c.; 18th, 14.225c.; 19th, 14.275c.; 21st, 14.30c.; 22d, 14.275c.; 23d, 14.125@14.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
17	59⅜	60¾	65½	280¾	276¾	34⅝	34⅜	38 3/16	37¼
18	60	61	66	281¾	277⅛	34¾	34½	38½	37½
21	60¼	61¼	66¼	286	279	34 9/16	34 5/16	38 7/16	37 7/16
22	60	61⅛	65¾	285½	278½	34¼	34⅛	38 5/16	37½
23	59⅝	60⅝	65½	286¼	279¼	34¾	34 7/16	38 5/16	37½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver		Gold London	Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.84⅝	68⅝	31 11/16	84s10½d	21	4.84½	69	31 13/16	84s11½d
18	4.84⅝	69	31 13/16	84s11½d	22	4.84½	69	31 13/16	84s11d
19	4.84⅝	69	31¾	....	23	4.84½	68⅞	31¾	84s11d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Advances Slightly

Sales of copper for the week ending today have not equaled those of last week, though a fair volume has been sold nevertheless, and at somewhat advanced prices. On Thursday, business was booked at both 14 and 14⅛c., delivered Valley, but in the next four days practically all sellers came up to 14⅛c. A good amount of business was done in the Middle West at 14⅛@14⅜c. Yesterday, consumers showed little interest, and it was possible to do 14⅛c. for Eastern deliveries, with that figure somewhat more freely quoted today, though some sellers continue at the 14⅛c. level. No one expects to do much business now until after Jan. 1, so there is not likely to be much pressure on the market even though but few orders are received. Most of the business has been for February or the first quarter. The foreign market has been quiet, with quotations of American agencies at from 14.30@14.40c., c.i.f.—somewhat above the offerings of dealers.

Lead a Little Stronger

The tone of the lead market is somewhat better, though prices show no quotable change from last week. The American Smelting & Refining Co. continues to quote 9.25c., New York, and is prepared to sell for any delivery at that level. Slight premiums have, in some instances, been secured by Middle Western producers, for deliveries in the East, though such business has not been large. Quotations down to 9⅛c. for future delivery have virtually disappeared with the improved prices now being quoted in London. Practically all the business done in the Middle West has been booked at the 9.10c. level quoted by the principal interest, though early in the week a little lead for January shipment was sold at 9.05c. In the last three or four days such offers seem to have disappeared; in fact dealers are asking 9.15c., St. Louis, for immediate shipment, but are meeting with little success, as producers seem to have enough lead coming out of their smelters to take care of any urgent demands, even for early delivery. The Chicago market has ruled at 9.15c. Desilverized has sold for slight premiums in the St. Louis market, and corroding grades are at the customary differential of $2@$3 per ton above common grades.

Zinc Unchanged

A fair amount of zinc has been sold, but much of it has been to operators rather than to consumers, who wish to

have the metal to take care of January delivery contracts. Prices are virtually unchanged, the premiums for spot metal continuing. Business has been well divided between spot and three or four months in the future, but most of the business has been done for January, around 8.55c. Immediate shipment is worth about 8.65@8.70c. today, ranging down to about 8.40c. for March, not quite the broad range of last week, but still a substantial one. Brass Special continues at about 20 points premium, and High-Grade at 10¼ @10½c., delivered.

Little Interest in Tin

Consumers recently have been interested in buying tin only after price declines, and as the market has been a fairly steady one during the last week, few sales have been made. Straits tin, however, has been depressed unduly in the New York market the last few days, prices quoted often being well below what might be expected judging from London quotations. The 99 per cent grade, however, has not been affected to such a degree, and the differential between it and Straits is, therefore, not quite so much. Prices for forward tin continue at from one-half to three-quarters of a cent below those asked for spot and near-by.

Silver Steady

The silver market has remained steady during the past week, fluctuations having been extremely narrow both in London and New York. China has been a moderate buyer and India has shown slightly more interest in the market. The approach of the Christmas holidays has caused a lack of interest, but in spite of the small business the present undertone appears to be fairly good.

Mexican Dollars: Dec. 17th, 52⅜c.; 18th, 19th, 21st and 22d, 53c.; 23d, 52⅞c.

Francs Slightly Higher

The franc is somewhat improved over a week ago, though the French financial situation continues bad. Closing cable quotations on Tuesday, Dec. 22, were: francs, 3.6525c.; lire, 4.0375c.; and marks, 23.81c. Canadian dollars, 3/32 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 29c. per lb.; 98 per cent, 28c. London, 98 per cent, £118 per long ton.

Antimony — Per pound, f.o.b. New York: Chinese brands, spot, 22@23c. February arrival, 21¾@22c. Cookson's "C" grade, spot, 23c. Chinese needle, lump, 16@17c. Standard powdered needle, 200 mesh, 19@20c. White oxide, Chinese, 99 per cent Sb_2O_3, 19@20c.

Bismuth—$3.25@$3.30 per lb., in ton lots. London, 12s. 6d.

Cadmium—60c. per lb. London, 1s. 9d.

Nickel—Ingot, 34c.; shot, 35c.; electrolytic, 38c. (99.75 per cent); London, £170@£175 per long ton. On 1926 contracts, an advance of 2c. is reported.

Osmium—$110 per oz.; London, £23 10s.@£25 10s.

Platinum—$120 per oz. refined officially quoted. Sales also at $115@$118. Crude, $114@$114.75. London, £23¾ @£25 for refined; crude £21½@£22½.

Quicksilver — Per 75-lb. flask: $89@$90 for spot; forward, $87@$88. San Francisco $90.17. London, £15@£15¼.

The prices of **Cobalt, Germanium Oxide, Iridium, Lithium, Magnesium, Molybdenum, Monel Metal, Palladium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of Dec. 5.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Caucasian, Bolivian, and Chilean, 40@42c.; nominal.

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $11.50@$12.50; Western scheelite, $12@$12.75.

Chrome Ore, Galena and **Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum,** and **Vanadium Ores** are unchanged from quotations in the Dec. 5 issue.

Zinc Blende and Lead Ore Prices Unchanged

Joplin, Mo., Dec. 19, 1925

Zinc Blende	Per Ton
High	$61.80
Premium, 60 per cent zinc	$57.00@$58.00
Prime Western, 60 per cent zinc	$56.00
Fines and slimes, 60 per cent zinc	$54.00@$51.00
Average settling price, all	$56.81
Galena	
High	$124.20
Basis 80 per cent lead	$115.00
Average settling price, all	$122.67

Shipments for the week: Blende, 16,001; calamine, 1,026; lead, 2,731 tons. Value, all ores the week, $1,286,120.

The highest production record of zinc concentrates was made this week, totaling 17,900 tons. Shipments fell short of the output almost 1,000 tons. Buyers would offer no higher basis price for zinc this week, and sellers were more inclined to accept these, especially those having mines within the school districts, where the concentrates in the bins on Dec. 31 are taxable for school purposes.

Lead-ore production continues close to 3,000 tons per week, but few sales having been made since the price was lowered to $115 per ton basis. Producers are thought to be holding for a higher price.

It is reported that practically all mines will cease ore production next Thursday night, Dec. 24, and a number of them are expected to remain idle for two weeks.

Platteville, Wis., Dec. 19, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$58.50
Lead Ore	
Lead, basis 80 per cent lead	$118.00

Shipments for the week: Blende, 1,073 tons; lead, 120 tons. Shipments for the year: Blende, 47,575; lead 2,371 tons. Shipments for the week to separating plants, 1,828 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Dec. 5 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3@3¼c. per lb. London, £14½@£15 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from prices in the Dec. 5 issue.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices in the Dec. 5 issue.

Metal Products

Rolled Copper—Sheets, 22½c.; wire, base price, 16c. per lb.

Lead Sheets—Full, 13½c. per lb.; cut, 13¾c..

Nickel Silver—29½c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 20½c. per lb.; rods, 17½c.

Zinc Sheets—12c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite** are unchanged from prices in the Dec. 5 issue.

Steel Firm—Pig Iron Dull

Pittsburgh, Dec. 22, 1925

The turnover in the steel market has grown rather light, reflecting both the fact of there having been unusual activity in November and the approach of the time of annual inventories and year-end adjustments.

Fundamentally the steel market seems to be as strong as at any time. Prices are showing no definite advancing tendency. This, mills ascribe to policy, it being recognized that some of the advances of a year ago did not have a favorable influence.

About 22,000 freight cars have been bought since Nov. 1, against 16,000 in the preceding five months and 35,000 in the first five months of the year. The year as a whole will run about one-fourth below the average of the past five years.

Pig Iron.—The pig iron market continues very dull, with prices fully maintained: Bessemer, $21; basic, $20; foundry, $20.50, f.o.b. Valley furnaces.

Connellsville Coke—When the spot market was at its weakest many furnace interests covered for first quarter, at $3.75 to $4. The spot market has turned sharply upward in the past week, advancing from $3.50 to about $5.

Mining Companies Liberal in December Dividends—Year's Total Over $200,000,000

The following dividends were paid by mining and metallurgical companies operating in the Americas, in December:

Companies in the United States	Situation	Per Share	Total
American Metal	U. S. and Mex.	$1.00 Q	$593,458
American Metal pfd	U. S. and Mex.	1.75 Q	87,500
American Smelting & Refining pfd	U. S. and Mex.	1.75 Q	875,000
Bingham Mines, s,l	Utah	1.00 Q	65,000
Butte Copper & Zinc, m,z,s,l	Mont.	0.50 A	300,000
Butte & Superior Mining, z,s	Mont.	0.50 Q	145,099
California Rand Silver, s,g	Calif	0.02 M	25,600
Calumet & Arizona, c	Ariz.	1.50 QW	964,135
Calumet & Hecla Consolidated, c	Mich.	0.50 Q	1,002,751
Consolidated Lead & Zinc	Kans.	1 per cent M	
Eagle Picher Lead, z,l	Okla.,Mo.,Kan.	$0.40 Q	400,000
Federal Mining & Smelting pfd., s,l,z	Idaho and Okla.	1.75 Q	210,000
Gladstone Mountain, l	Wash.	0.005 M	6,024
Golden Cycle Mng. & Red., g	Colo.	0.03 Q	45,000
Great Northern Iron Ore	Minn.	0.75 K	1,125,000
Hecla Mining, l,s	Idaho	0.50 Q	500,000
Homestake Mining, g	S. D.	0.50 M	125,580
Inland Steel	Minn.	0.625 Q	739,249
Isle Royale Copper	Mich.	1.00 K	150,000
International Nickel, n,c	W. Va., Ont.	0.50 Q	836,692
Mammoth Mining, l,s,c,g	Utah	0.10 K	39,531
Mohawk Mining, c	Mich.	1.00 Q	115,000
Mother Load Coalition, c,s	Alaska	0.375 SA	937,500
National Lead	U. S.	2.00 Q	413,108
National Lead pfd	U. S.	1.75 Q	426,433
Nevada Consolidated Copper	Nev.	0.25 Q	499,864
New Jersey Zinc	U. S.	2.00 X	981,632
St. Joseph Lead	Mo.	1.50 QY	2,904,955
Silver King Coalition, s,l	Utah	0.10 X	121,610
Sloss-Sheffield Steel & Iron	Ala.	1.50 Q	150,000
Tennessee Copper & Chemical	Tenn.	0.25 Q	198,650
Texas Gulf Sulphur	Texas	2.75 QU	1,746,250
Tintic Standard, s,l,c	Utah	0.50 QZ	576,457
United States Steel	U. S.	1.75 QW	8,895,294
Utah Copper	Utah	1.25 Q	2,030,612
Yellow Pine, z,l,s	Nev.	0.04 Q	40,000
Companies in other countries:			
Cerro de Pasco, c,s	Peru	1.00 X	1,122,842
Chile Copper	Chile	0.625 Q	2,744,527
Hollinger Consolidated Gold	Ont.	0.16 V	787,200
Lake Shore, g	Ont.	0.10 QT	200,000
Lucky Tiger-Combination, g,s	Sonora	0.16 MS	114,454
McIntyre Porcupine, g	Ont.	0.25 Q	199,500
Mexico Mines of El Oro, g,s	Mex.	2s. 6d.	£26,250
Total			$33,440,577

s, silver; l, lead; m, manganese; z, zinc; g, gold; c, copper; n, nickel; Q, quarterly; A, annually; M, monthly; SA, semi-annually; W, includes 50c. extra; K, paid irregularly; X, extra dividend; Y, includes $1 extra; U, includes $2 extra; Z, includes 30c. extra; V, two dividends of 8c. each, one paid Dec. 2 and the other Dec. 31; T, includes 5c. extra; S, includes 9c. extra.

Increasing prosperity of the mining industries is reflected in the dividends paid in December, which not only set a new record for monthly payments in 1925 but are about $7,000,000, or 25 per cent, greater than was paid in December a year ago. Among the companies that resumed payments in December are Nevada Consolidated, which had paid nothing since Sept. 20, 1920. Most of the increase, however, was because of advances in the rates of those which had been paying dividends before, or because of extra dividends to help fill the Christmas stocking. Among the companies that raised their regular rate for present and future disbursements are: American Metal, $1 instead of 75c.; Bingham Mines, $1 instead of 50c.; Utah Copper $1.25 instead of $1; and St. Joseph Lead, which declared increased dividends of 75c. per share per quarter for the entire year 1926, and may pay extras besides. The companies paying year-end extras are indicated by footnote references in the table given above.

Great Northern Iron Ore Properties disappointed some by declaring only 75c. a share, compared with $2 a year ago, but it is well known that iron ore prices were not sufficiently high during the season just closed to make for any unusual prosperity on the iron ranges. United Verde Copper also omitted to pay any dividend this month. No regular dividend policy is maintained by this company, which only has twenty or so stockholders, but payments have usually been made quarterly and the last was on Sept. 20, of $2 per share. There is nothing to indicate that the company is not making as much money as ever.

Total dividends paid by mining companies, reported in these columns, amounted to $203,000,000 in 1925, compared with $177,000,000 in 1924. Additional amounts were paid by companies of which we have no record, and by private operators. Also many industrial companies operate mines, which are not included. However, the totals are comparative, and show an increase in dividend disbursements of about 15 per cent in 1925 compared with 1924. It is thought that conditions in the mining industries really have improved more than this indicates.

London Debates Alteration of Lead Contract

Two opinions prevail in London as to whether the present contract of the London Metal Exchange, by which only lead arriving at the Port of London is good delivery, should be changed. The *Ironmonger* comments on the question as follows:

"By far the greater proportion of lead imported into this country arrives in London from Australia, Burma, South Africa, and other British dominions, and from Spain. On the other hand, most of the lead coming from the United States is sent to Liverpool, and to be good delivery has to be brought to London. Nevertheless, the proportion of American lead coming to this country is not small, and in October amounted to about 4,500 tons, out of a total of just over 25,000 tons imported.

"When the supplies of lead are normal the position on the London Metal Exchange is not greatly affected by the present contract. If, from any cause, consumption exceeds the demand, or any interruption takes place in the supplies of Australian lead, such as resulted from the recent shipping strike, the fact that London is the only port recognized by the Metal Exchange contract accentuates the shortage. . . .

"The control of the English lead market by foreign organizations is a thing of the past; yet it is argued that as the lead contract remains substantially the same as in those days, the market is more susceptible to artificial manipulation than that of any other metal dealt in on the London Metal Exchange.

"Not unnaturally, one consequence of a constriction of supplies of lead entering London is to advance the price, and when prices are high, consumers naturally restrict their purchases and also limit their buying to their immediate requirements. The effect of this policy is largely to increase the demand for metal for near delivery. This causes the price of near metal to advance beyond that for forward, and establishes what is known as a backwardation in the market. In the lead market this condition has existed for so long that it is regarded almost as a normal state of affairs. At the same time, a section of the market is dissatisfied with the situation, and the view is being expressed once again that the time is ripe for the alteration of the present contract.

"The objection to a persistent backwardation is that it operates against the use of the market for hedging purposes. It used to be a practice of lead producers to sell in the market against their purchases of ores, and this was a sound operation so long as a contango usually existed—that is, while the forward price was higher than the cash. The producer generally found such a transaction to his advantage, and even if he did not actually benefit, he usually regarded a comparatively small loss as insurance against a fall in price between the purchase of his ores and the sale of his refined metal. When a backwardation exists, the situation is exactly reversed, and for a long time past those unfortunate producers who have attempted to hedge have found, when their date for delivery matured, that they have had to buy-in at prices considerably above those at which they sold. It is claimed, therefore, that the market has ceased to perform one of its most important functions. Against this argument it is urged that the lead producers of the British Empire would be subjected to more direct competition than at present from American or Mexican lead.

"At the moment, it seems that those who believe that the conditions of the market can be bettered by the alteration of the contract, and those who oppose a change, are likely to join issue in an interesting struggle. The easing of the situation by the conclusion of the Australian shipping strike coincided with a seasonal falling off in consumption. At the same time, large quantities of lead were attracted to this country by the high prices which ruled in the London market. Consequently, the near price fell more rapidly than the forward quotation, and the backwardation dropped to about 12s. 6d. One of the leading metal-trade interests promptly took up a considerable quantity of lead at this figure, and it is rumored, intends, if necessary, to place several thousand tons in stock in this country. If this plan is carried out, it may have the effect of bringing about conditions in which a contango will be more usual than a backwardation."

Current Prices of Mine Materials and Supplies

Rise and Fall of the Market

Materials showing upward trend in prices are: steel sheets, track supplies, cast-iron pipe, hollow tile, pine and fir timbers. Declines occurred during the month in cut nails, white and red lead, litharge, and zinc dust. Steel pipe and standard rails have not changed in price since 1922.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Blue Annealed No. 10	$2.50	$3.60	$3.50	$3.85	$3.89
Black No. 28	3.35	4.60	4.10	4.80	4.35
Galvanized No. 28	4.60	5.70	5.25	6.00	5.35

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in and larger	$2.90@3.00	$2.80	$3.55	$3.65@3.75	$4.35	$2.90
Track bolts	3.90@4.15	3.75@4.00	4.55	4.25@4.35	5.85	3.90
Standard section angle bars	2.75	2.75	3.40	3.25@3.75	4.00	3.85

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channel, 3 to 15 in.	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 6 in., ¼ in. thick	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates	1.90	2.00	3.34	4.15	3.25	3.10	3.30

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	50%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	50@60%	55%	60%

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD—	⅛ to 3	62	50½	⅛ to 1½	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$51.60@52.60	$55.60@56.60	$41.00 @ 42.00 base	$50.20@51.20	$48.00	$53.00

NUTS—Semi-finished, ½x¼-in., 2c. each. Discount 70% for ⅝-in. and smaller; 65% for ¾-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1112	$0.1162	$0.075	$0.12	$0.07	$0.108	...
6x12x12	.1667	.1743	.09¢	.....	.095	.156	$0.252*
8x12x12	.2084	.2179	.135	.22	.132	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—⅝x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers at yards in San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago 20 Ft. and Under	Chicago 22-24 Ft.
3x4 to 8x8	$49.00	$50.00	$42.00	$43.00
3x10 to 10x10	53.00	54.00	47 50	48 50
3x12 to 12x12	57.00	58.00	57.00	58.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$50.00	$48.00†	$51.00	$50.00	$60.00	$58.00†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	32.75	33.75	33.75	.....	32.75
Minneapolis	42.00	36.75	35.00	.....	44 50	36.75
Kansas City, Mo.	44.50	40.75	.....	.....	59.50	41.75
Philadelphia	56.00	34.00	37.00	40.00	67.00	34.00

*Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.15	$3.50	$4.25	$2.93	$4.95
Cut	2.80	....	5.00	5.00	3 13	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
NewYork, del. by truck	$2.50@2.70	$2.50@2.60	$2.50@2.60
Chicago, f.o.b.	2.10	2.10	2.20
Cleveland, f.o.b.	2 29	2.29	2.39

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	280-lb. net Common
New York	$18.20	$12.@13.10	$3.50	$2.25@$2.75
Chicago	20.00	18.00	....	(180-lb. net) 1.30

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.99	$1.11	$1.02	$1.05

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	15.25	16.25	16.75
White	15.25	15.25	15.25	15.25

HOSE—Quotations at New York warehouses:

Fire Protection — 50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket — 71c per ft.

Air—Best Grade
¾-in., per ft. — 3 ply $0.37½ 4 ply $0.46

Steam—Discounts from List
First grade 30–10% Second grade 40% Third grade 40–10%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.
Best grade 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40%
Heavy	30–10%

RAWHIDE LACING—For cut, best grade, 50%, 2nd grade, 60%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ½ in.	$0.90
Rubber sheet	.45
Rubber sheet, wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.34	New Orleans	$0.24½
New York	.26	Seattle	.24
Chicago	.24½	San Francisco	.24

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.233	.26
San Francisco	.1625	.1925

FLOTATION OIL—
Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. — $0.37

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. works, per lb.	$0.09@.10
Litharge, f.o.b. New York, kegs, per 100 lb.	15.25
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	18@.22
Calcium carbide, in drums, f.o.b. works, per lb.	05½@.06

Mining Stocks—Week Ended December 19, 1925

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	51	49	49⅜	Oc.17,No.23,Q	0.75
Arcadian Consol.	Boston	*75	*50	*50		
Ariz. Com'l.	Boston	13	12½	12½	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	4	3⅞	3⅞		
Calumet & Arizona	New York	56⅞	55½	56½	De.4, De.21 QX	1.50
Calumet & Hecla	Boston	14	13⅛	13⅜	Nov.30,De.15 Q	0.50
Cerro de Pasco	New York	62½	60⅛	60⅛	De.10, De.22,X	1.00
Chile Copper	New York	34⅝	33⅛	34	Dec.2, Dec.28, Q	0.62½
Chino	New York	20	19	19½	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	2	1⅞	2		
Copper Range	Boston	20	18⅞	18⅞	May, 1925	1.00
Crystal Copper	Boston Curb	*49	*45	*48		
East Butte	Boston	4	3 7/16	3 7/16	Dec., 1919	0.50
First National	Boston Curb	...	...	*18	Feb., 1919	0.15
Franklin	Boston			*70		
Granby Consol.	New York	21⅜	20½	20⅞	May, 1919	1.25
Greene-Cananea	New York	13¼	12½	13⅜	Nov., 1920	0.50
Hancock	Boston			*50		
HoweSound,new,r.t.c.	New York	28½	27½	27⅝	Oc.5, Oc. 15 Q	0.50
Inspiration Consl.	New York	26⅜	25⅜	25⅝	De.17, Ja.4, Q	0.50
Iron Cap	Boston Curb	2⅝	2⅜	2⅜	May, 1923	0.15
Isle Royale	Boston	12	11¼	11⅜	No.30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	*94	*80	*90		
Kennecott	New York	55½	53⅛	54	De.4,Jan.2 Q	1.00
Lake Copper	Boston	1½	1 1/16	1 1/16	June, 1925	0.50
Magma Copper	New York	43⅞	43¼	43⅛	De.31, Ja.15,	0.75
Mason Valley	N. Y. Curb	2	1⅛	1⅛		
Mass Consolidated	Boston	*55	*51	*55	Nov., 1917	1.00
Miami Copper	New York	12⅛	11⅛	12	No.2, No.16 Q	0.25
Mohawk	Boston	33⅛	32¼	32⅛	Oc.31, De.2	1.00
Mother Lode Coa.	New York	7⅛	7⅛	7⅛	De. 11, De. 31	0.37½
Nevada Consol.	New York	13⅞	13¾	13⅞	De. 18, De.31 Q	0.25
New Cornelia	Boston	19⅛	18⅞	18⅞	No.6, No.23 Q	0.25
North Butte	Boston	3⅛	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*78	*75	*75	No. 14, De. 2	0.05
Old Dominion	Boston	19	17⅜	18	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†126	†122		De.21, Ja.2 Q	1.00
Quincy	Boston	22⅛	21	21⅛	Mar., 1920	1.00
Ray Consolidated	New York	12¼	12⅛	12⅛	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			14		
St. Mary's Min. Ld.	Boston	38¼	35	35⅛	May, 1925	3.00
Seneca Copper	Boston	10⅛	10⅛	10⅛		
Shannon	Boston	*65	*50	*50	Nov., 1917	0.25
Shattuck Arizona	New York	70⅞	68¼	69⅛	Jan.,1920	0.25
Superior & Boston	Boston	1	*80	*80		
Tenn. C. & C.	New York	14⅞	14	14⅛	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	27⅛	26⅛	27	Oc. 6, Nov. 20	0.75
Utah Copper	New York	103	103	103	De.18, De.31, Q	1.25
Utah Metal & T.	Boston	*70	*62	*62	Dec., 1917	0.30
Victoria	Boston	*30	*30	*30		
Walker Mining	Salt Lake	1.55	1.50	1.50		
NICKEL-COPPER						
Internat. Nickel	New York	46⅛	44⅛	44⅛	De.17,De.31,Q	0.50
Internat. Nickel, pfd.	New York	101½	101½	101½	Oc.15, No.2, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*34	*30	*30	No. 1, No. 10 M	0.0½
National Lead	New York	168⅝	162½	166	De.11, De.31 Q	2.00
National Lead pfd.	New York	116½	116½	116½	Aug.21, Se.15	1.75
St. Joseph Lead	New York	44¾	43	43	De.10,De.20QX	1.50
ZINC						
Am. Z. L. & S.	New York	10	9	9	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	43	38	38	Nov., 1920	1.50
Butte C. & Z.	New York	6½	5⅝	5⅝	De.10, De.24	0.50
Butte & Superior	New York	16⅜	14	14½	De.15, De.31 Q	0.50
Callahan Zn-Ld	New York	2	1⅜	1⅜	Dec., 1920	0.50
Eagle Picher	Cincinnati	34½	33¼	33⅜	De.1, De.31	0.40
Eagle Picher, pfd.	Cincinnatl			110		
New Jersey Zn.	N. Y. Curb	209	206	207½	No.20,Dec.10 X	2.00
United Zinc	N. Y. Curb	*55	*55	*55		
Yellow Pine	Los Angeles	*41½	*37½	*40½	Se.10 Se.21 Q	0.04
GOLD						
Alaska Juneau	New York	1⅞	1⅜	1⅜		
Argonaut	Toronto	*15⅝	*15	*15½		
Barry-Hollinger	Toronto	*25	*24	*24½		
Carson Hill	Boston	*60	*30	*60		
Consol. W. Dome L.	Toronto	*17	*16½	*16⅞		
Cresson Consol. G.	N. Y. Curb	2¾	2⅜	2⅜	Se.30, Oc.10	0.10
Crown Reserve	Toronto	*20⅜	*19⅜	*20	Jan., 1917	0.05
Dome Mines	New York	17½	16⅜	16⅜	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	†1.60	†1.59		No.30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	17.25	17.15	17.15	De.14, De.31	0.08
Homestake Mining	New York	48	48	48	De.19, De.26 M	0.50
Kirkland Lake	Toronto	*76	*74	*74½		
Lake Shore	Toronto	9.10	8.85	8.90	De.1,De.15 XQ	0.10
McIntyre-Porcupine	New York	21⅜	21½	21⅜	No.2, De.1 Q	0.25
Newray	Toronto	*38	*35	*37		
Night Hawk Pen.	Toronto	*7	*6	*6½		
Portland	Colo. Springs	....	....	†1	Oct., 1920	0.01
Rand Mines	New York			34½	Au.17, Au.25	1.52
Teck-Hughes	Toronto	2.38	2.15	2.20	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*55	*55	*55	Dec., 1919	0.02
Tough-Oakes	Toronto	*49	*48¾	*48¾		
United Eastern	N. Y. Curb			*45	July, 1924	0.05
Vipond Cons.	Toronto	1.54	1.46	1.47		
Wright-Hargreaves	Toronto	7.35	7.00	7.20	De.15, Ja. 1 QX	0.10
GOLD AND SILVER						
Black Oak	N. Y. Curb	...	...	*81		
Carnegie Metals	Pittsburgh	18⅜	18	18		
Con. Cortez	N. Y. Curb	*6	*6	*6		
Con. Virginia	San Francisco	*15⅛	*13⅛	*15⅛		
Continental Mines	N. Y. Curb	*70	*45	*45		
Dolores Esperanza	N. Y. Curb	*68	*68	*68	July, 1923	0.05
Premier Gold	N. Y. Curb	2½	2⅛	2⅛	De.18, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	*2⅛	*1⅞	*2⅛	Se.15, Oc.1	0.05
Tonopah Divide	N. Y. Curb	...	...	*23	Oct., 1923	0.10
Tonopah Extension	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5	4⅞	5	Se.30, Oc.21	0.07½
Unity Gold	N. Y. Curb			*50		
West End Consol.	N. Y. Curb	*30	*30	*30	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*50	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	*76	*76	*76	Oct., 1920	0.50
Beaver Consol.	Toronto	*50	*48	*49½	May. 1920	0.03
Castle-Trethewey	Toronto	1.44	1.43	1.43		
Coniagas	Toronto	4.35	3.90	4.30	May, 1924	0.12½
Keeley	Toronto	1.64	1.57	1.60	Au.31,Se.15 X	0.12
Kerr Lake	N. Y. Curb	1¼	1⅛	1¼	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*39	*35	*38	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*97	*80	*90	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*21	*20	*20½	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.20	3.07	3.10	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	6⅛	6	6⅛	De.31, Ja.2, Q	0.15
Park Utah Cons.	New York	8	8	8	De. 15, Ja. 2	0.15
Temiskaming	Toronto	*12	*12	*12	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	9⅛	8⅛	8⅞	De.15,Ja.2, X	0.25
Alta Merger	Salt Lake	†9	†2			
Bingham Mines	Boston	56	53	54½	De.19, De.20 Q	1.00
Cardiff M. & M.	Salt Lake	*57	*57	*57	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.82½	3.80	3.80	Oc. 10, No. 1	0.10
Emma Silver	Salt Lake	†1½	†1			
Erupcion	Boston Curb	1⅝	1⅝	1⅞	De.15, Ja.2, X	0.10
Federal M. & S.	New York	77½	74	74	No.25, De.15 Q	1.75
Federal M. & S., pfd.	New York	96¾	94	95	Au.25, Se.15	1.75
Hecla Mining	N. Y. Curb	18	17½	18	No.15, De.15 Q	0.50
Iron King Mining	Salt Lake	*45	*39	*39		
Keystone Mining	Salt Lake	*63	*59	*63	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*12⅜	*12⅜	*12⅜		
Mammoth Mining	Salt Lake	2.85	2.57½	2.65	De. 16, De. 23	0.10
Marsh Mines	Spokane	*7⅛	*7⅛	*7⅛	Se.15, Oc.1	0.15
Park Utah	Salt Lake	7.10	7.00	7.10	Se.15, Oc.1	0.15
Silver King Coal	Salt Lake	10.12½	9.55	9.55	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*37	*33⅜	*37	Oc.1, Oc.10	0.01
Tamarack-Custer	Spokane	*35	*33	*34	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.25	13.75	13.75	De.16,De.23,QX	0.50
Utah-Apex	Boston	6⅞	6⅛	6⅝	Oc.3, Oc.15, Q	0.35
Western Utah Copper	N. Y. Curb	...	...	*10		
IRON						
Bethlehem Steel	New York	49⅜	47⅜	47½	July, 1924	1.25
Colorado Fuel & Iron	New York	38⅛	37⅜	36⅜	May, 1921	0.75
Gt. North'n Iron Ore	New York	26⅛	25⅝	26⅜	De. 4, De. 28,	0.75
Inland Steel	New York	43⅞	43	43⅜	No.13, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅜	1⅛	1⅛		
Replogle Steel	New York	15¼	14⅛	14⅜		
Republic I. & S.	New York	61	58⅛	59⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	94⅞	92⅜	94	De.15, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	136	133	134½	De.10, De.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	104	De.21, Ja.2, Q	1.75
U. S. Steel	New York	136	132⅞	133½	No.28,De.30 XQ	1.75
U. S. Steel pfd.	New York	126⅛	125⅛	125⅜	No. 3, No. 28, Q	1.75
Virginia I. C. & C.	New York	43	42¼	43	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	..	.	77	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	33	31⅛	31⅛	No.2, No.16 Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	96	94½	95	Se.30, Oc.15 Q	1.50
Asbestos Corp., pfd.	Montreal	116	114	114	Se.30, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	21⅛	19⅝	20	Nov., 1919	1.00
Texas Gulf	New York	119½	116	117	De.1, De.15,QX	2.75
DIAMONDS						
De Beers Consol.	New York	...	...	27½	Jy.27, Au.30	0.97
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	6	5⅜	5⅞		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	55	52⅜	53⅞	No. 20, De. 1, Q	1.00
Amer. Metal pfd.	New York	117	117	117	No. 21, De. 1, Q	1.75
Amer. Sm. & Ref.	New York	134⅞	131	132⅜	Oc.16, No.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	114	113	114	No.6, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	154¾	149	153¼	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	24	24	24		
Newmont Mining	N. Y. Curb	46⅞	45⅜	46	De.31, Ja.15,	0.60
Southwest Metals	N. Y. Curb			2⅜		
U. S. Sm. R. & M.	New York	48⅜	46⅛	47⅛	Oc.7, Oc.15, Q	0.75
U.S. Sm. R.&M.pfd.	New York	136	132⅞	133⅛	Oc.7, Oc.15, Q	0.87½

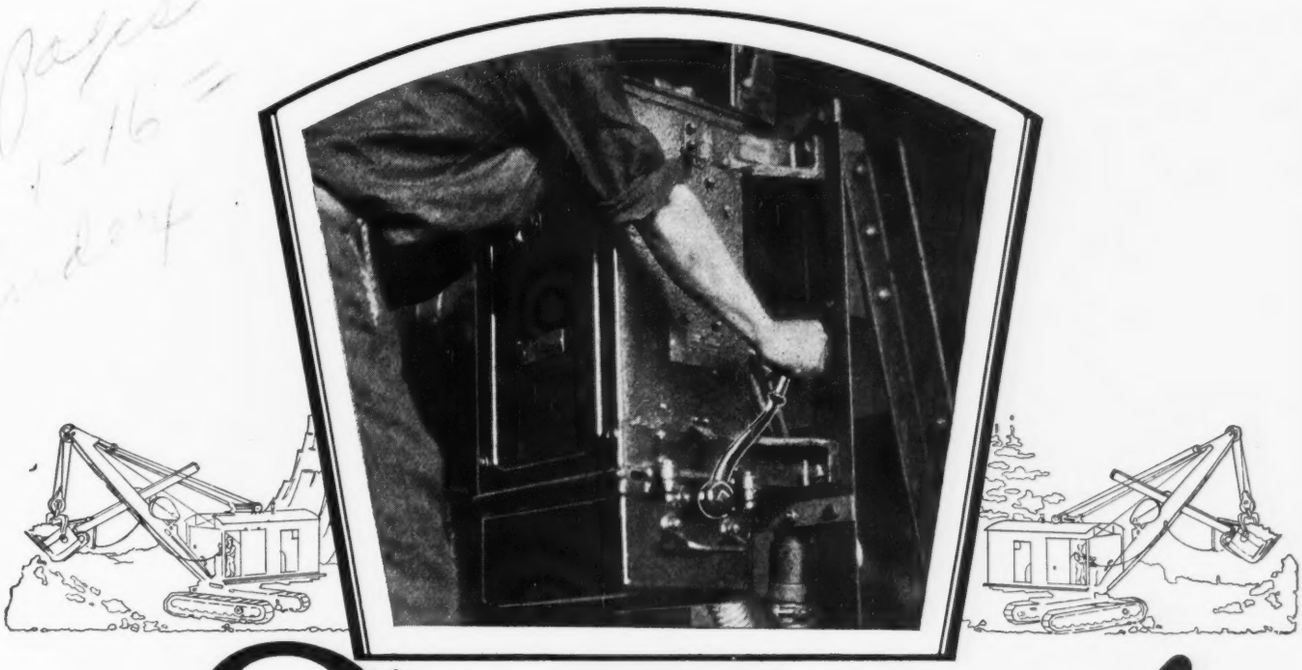
* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.

LONDON QUOTATIONS, WEEK ENDED DEC. 12, 1925

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	83/9	77/6	77/6	Nov. 1925	5(c)
British Platinum	7/6	5/9	7/6	Feb. 1925	2½
Burma Corpn. (10 rupees)	18/10½	18/—	18/3	Aug. 1925	6 annas.
Bwana M'Kubwa	7/1½	6/9	7/—		
Camp Bird	6/—	5/3	5/6		
El Oro	5/9	5/4½	5/9	Nov. 1924	2½*
Esperanza	1/—	—/9	1/—		
Frontino & Bolivia	7/6	7/3	7/6	Jan. 1926	1½
Mexican Corporation	21/7½	19/9	21/3	Dec. 17	2/6
Mexican Mines of El Oro	37/6	35/—	36/3	Dec. 1925	12½*
Nechi (pref. 10s.)	2/6	2/—	2/—	1921–22	25
Oroville Dredging	3/9	3/6	3/9	Dec. 1923	3¾
Ouro Preto	2/9	1/3	2/6	May 1925	2½
St. John del Rey	10/10½	10/—	10/—	June 1925	6¼
San Francisco Mines	29/—	28/3	28/6	June 1925	15
Santa Gertrudis	21/4½	20/—	20/6	July 1920	5
Selukwe (2s. 6d.)	13/6	11/3	12/3	April 1917	6¾
S. American Copper	5/10½	5/3	5/6	Nov. 1917	75
Tanganyika	48/6	44/4½	45/7½	Sept. 1925	5
Tomboy	4/3	4/—	4/3	Sept. 1925	5
Union Minière du Haut-Katanga (Brussels) 100 Fr.	7.000	6.750	6.990	July 1925	150(b)

* Free of British income tax. (b) Belgian francs. (c) Swiss francs.



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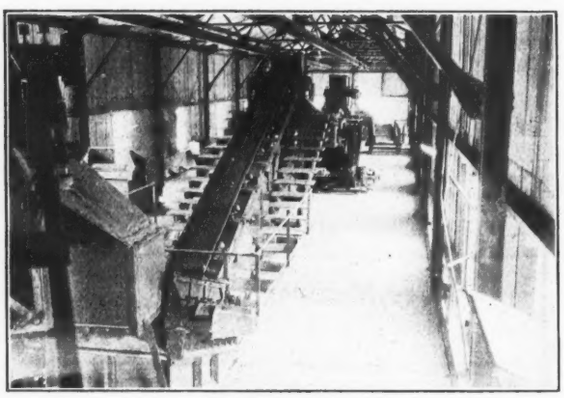

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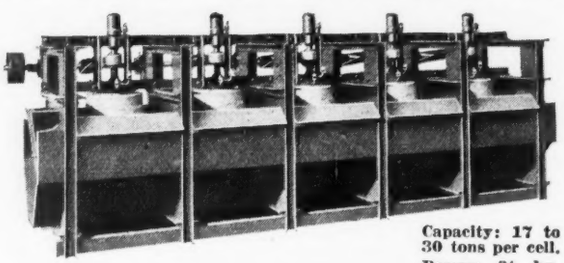

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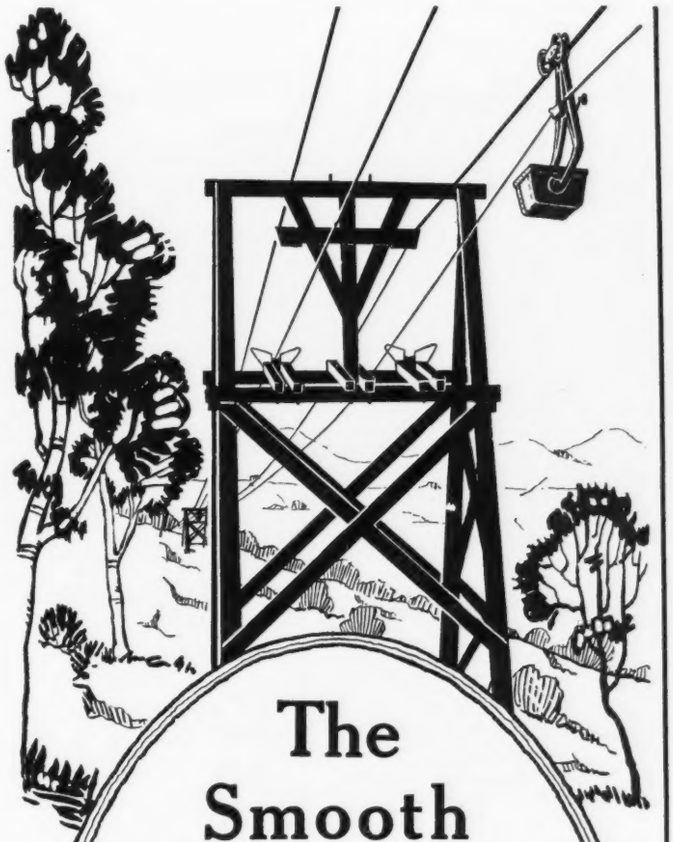

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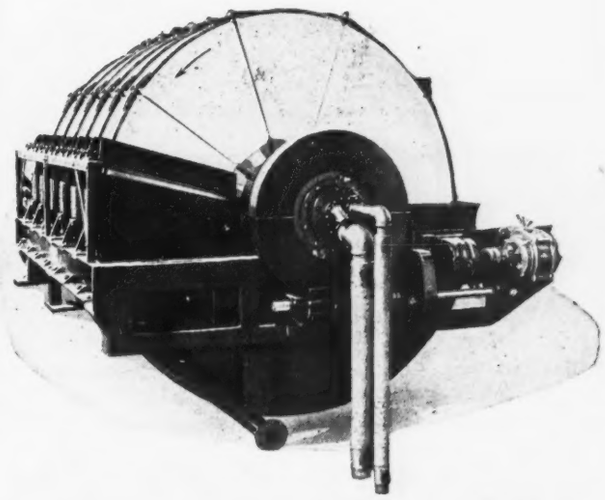

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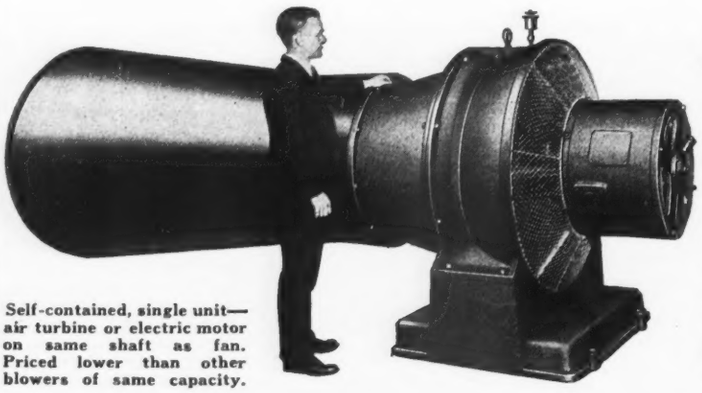

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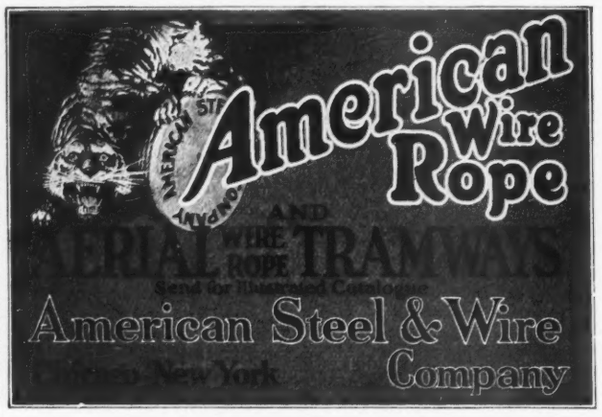

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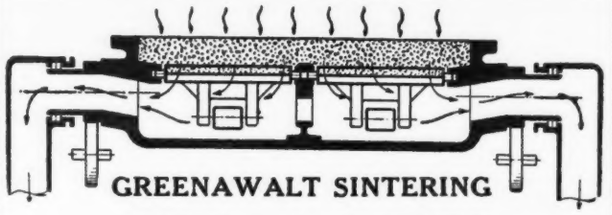

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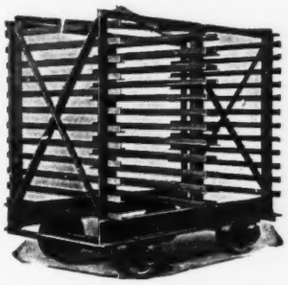

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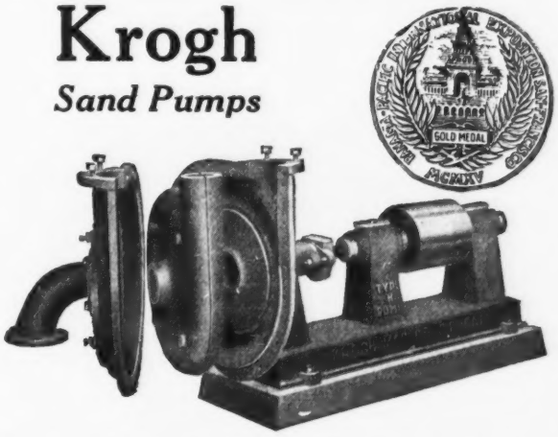

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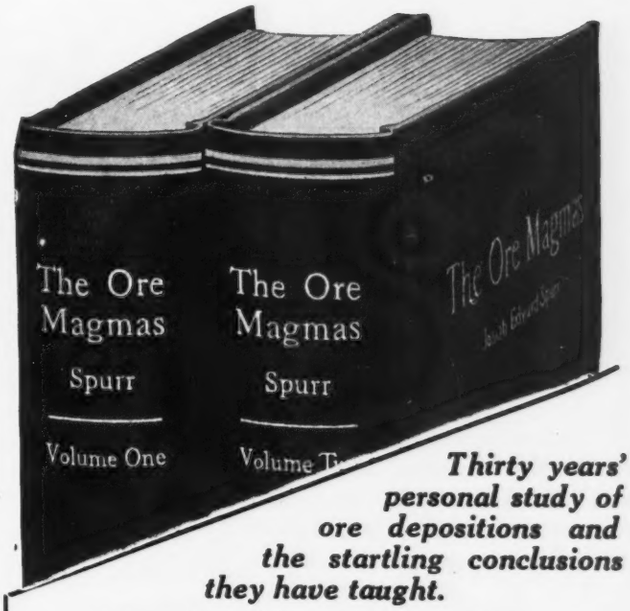

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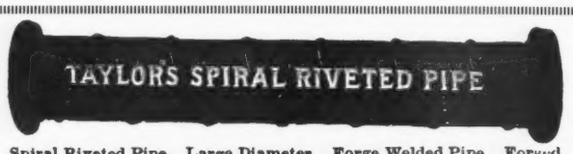

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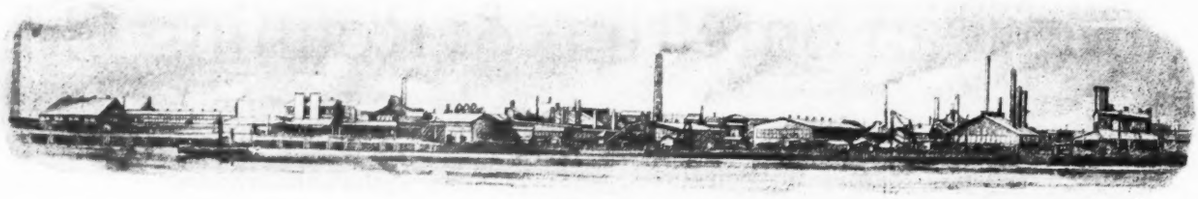

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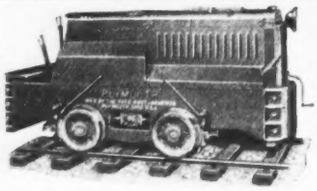

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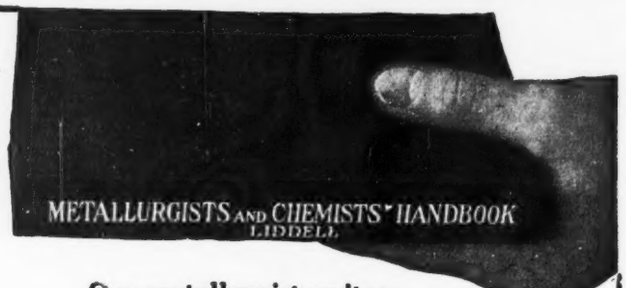

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White, Charles H., Consulting Geologist. 340 Mills Bldg., San Francisco.

White, J. E., Consulting Engineer. Bothin Bldg., Santa Barbara, California.

Whitman, Alfred R., Mining Geologist. Underground Programmes. Orebody Problems. Univ. of Cal., Southern Branch, Los Angeles, Cal.

Wilkens and Devereux, Consulting Mining Engineers. 120 B'way, N. Y., 7 Victoria Ave., London. Cable: Konreux. Code: Bedford-McNeill.

Wilson, Ridgeway R., Mining Engineer. Victoria, B. C., Canada.

Witherell, Charles S., Metallurgical Engineer. 150 Nassau St., N. Y. Cable: "Metwith." Phone Beekman 4957.

Wolf, Harry J., Mining Engineer. 42 Broadway, New York. Cable: Minewolf. Codes: Bedford-McNeill.

Wright, Charles Will, Mining Engineer. Via Francesco Crispi 10, Rome (6). Tel. 14-85. Telegraphic Address: Minesplor, Rome.

Wroth, James S., Mining Engineer. Room 827, 2 Rector St., New York.

Wyman, Henry, Consulting Metallurgist. Zacatacus, Zac., Mexico.

Y

Yeatman & Berry, Pope Yeatman, Edwin S. Berry, Consulting Mining Engineers. Examination, Development and Management of Properties. Room 2030 165 Broadway, New York. Cable: Ikona. Code: Bedford-McNeill.

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Zalinski, Edward R., Mining Engineer. 524 Newhouse Bldg., Salt Lake City. Examination Geological Mapping Development.

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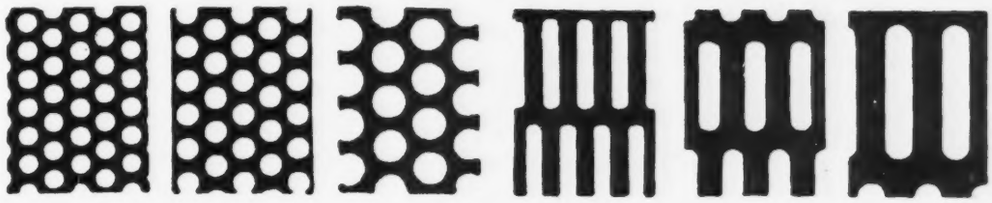

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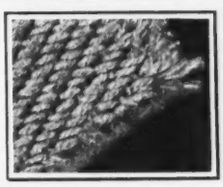

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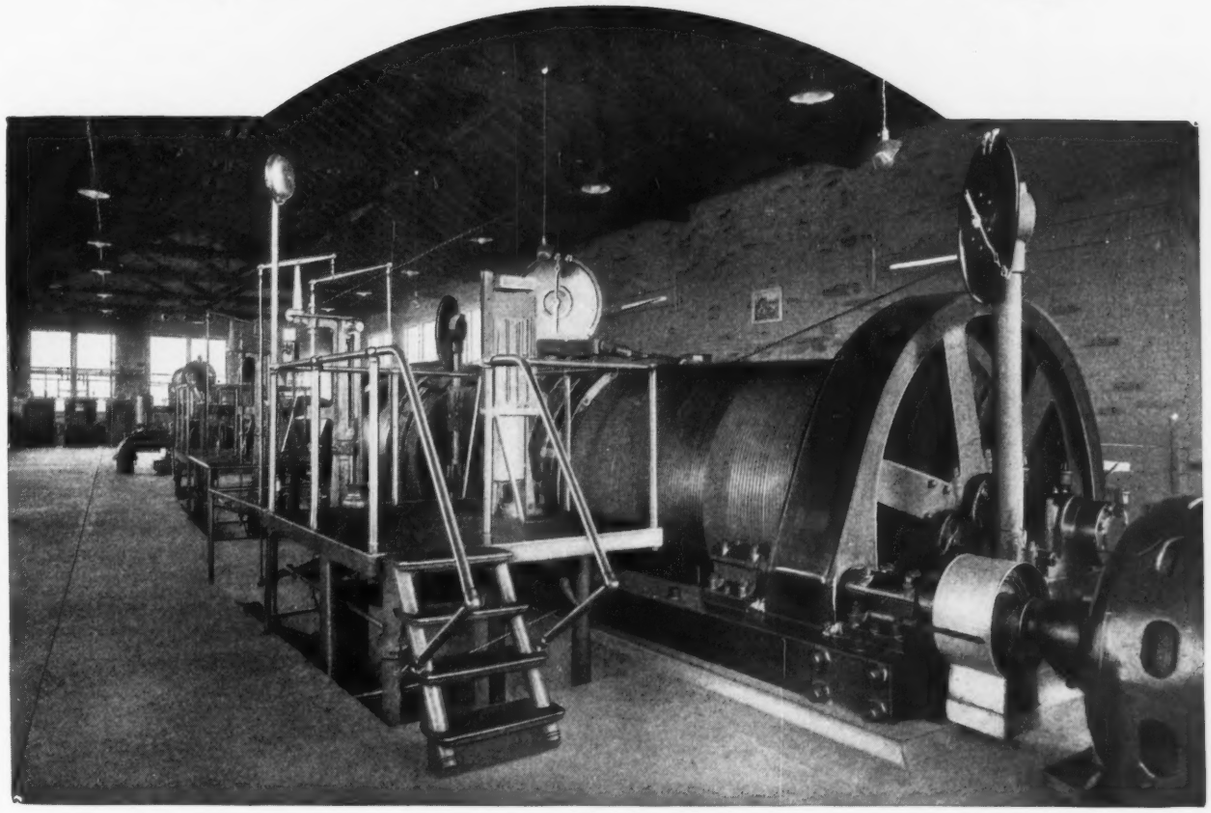

Two Nordberg Hoists installed at the Wickwire Mining Co., Iron River, Mich.

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The single drum hoist in the foreground has a drum of 7-ft. diameter and 108-in. face. It is driven by a 250-hp. motor and winds 1500 ft. of 1⅛-in. rope. The hoist in the background is also of the single drum type but has a differential drum, the diameters being 6 ft. and 7 ft. with faces 42 in. and 48 in. winding 1130 and 1150 ft. of 1⅛-in. and 1¼-in. rope respectively. It is also driven by a 250-hp. motor.

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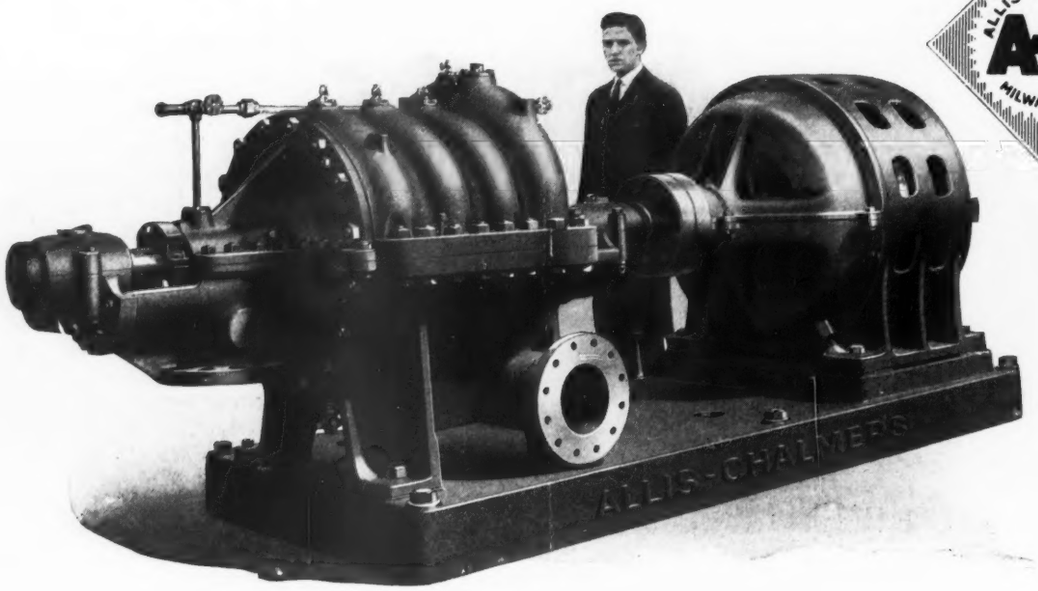

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